The

Electrical Review

VOL. CIV. FEBRUARY 15, 1929. No. 2,673.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman. H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors*: G. H. ALABASTER, Assoc.I.E.E. E. A. GATEHOUSE, M.I.E.E., A.M.INST.C.E. *Commercial Editor*: A. H. BRIDGE.

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Telegraphic Address "AGEKAY CENT., LONDON." Code, A B C. Telephone No.: Central 5871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Mechanical Vibration.

IN bygone days when super-power stations were perhaps dreamt of, but never discussed, when even the most brilliant of the electrical prophets who have lived long enough to see the refutation of the pessimist had not designed a "grid" system of distribution, other electrical engineers concerned with small non-condensing steam-driven stations had occasion to study the law of nuisance and to contest allegations of nuisance caused by noise and vibration. To-day such cases, in which generating stations are concerned, are few and far between; but a far larger proportion of the community is now concerned with the effects of vibration on a scale and over areas which are very extensive.

We refer to the alleged effect of traffic vibration: the popular Press is concerned with recording almost daily some gas explosion, or some failure of a water main ascribed to this cause; our office walls and windows are not sound proof against traffic noises, very often the walls themselves crack, or a ceiling falls down; but, in comparison with undertakings supplying gas and water, authorised distributors of electricity are better placed, for their troubles, when leaking gas has accumulated in the bricked pits in which joint boxes are placed, are not of such a costly nature as, say, a fractured water main.

We have written "alleged" effect of traffic vibration: the presumptive evidence appears to be strong, but direct evidence which will connect any given failure with either abnormal vibration due to certain classes of heavy traffic, or the smaller almost ceaseless vibration due to normal traffic, is lacking. In this respect there is a reasonable analogy between engineering and medical science: medical men giving evidence in criminal cases in which poisoning is alleged have to deal with the cumulative effect of minute doses of poison administered day in day out to patients unaware of its presence in their food; while in other poisoning cases the expert has been concerned with the rapid and fatal effect of one, or two, large doses, in which case diagnosis is relatively easy and conviction of the guilty sooner assured. So, also, with respect to vibration (in its severe forms), cause, effect, and remedies are obvious; but when it is a matter of small doses, causes may be disputed, and effects may be ignored until the damage has been done. As that climax may be the resultant of

several causes, the remedies admit of almost more debate than the causes.

There is therefore need to study the effects of attenuation, reflection, and amplification of vibration. In any uniform medium attenuation (or diminution) of amplitare probably varies inversely as the square of the distance between the source and the point of reception. The soil is not uniform, so further coefficients will be necessary for different media. Reflection is largely a matter of mass; the deep foundations of a modern building reflect the earth waves impinging on them, and when such reflected waves meet the next oncoming wave, there is an aggravation of effect at the point of meeting. Amplification, too, is important; in a moderate sea a small coasting steamer will roll severely when a large liner is unaffected. In any building the horizontal vibrational movement increases with the height above the street level, but in different buildings the effect at the same height will differ with its mass and also with its rigidity. The problem being complex, the sooner it is studied systematically, and direct evidence produced, the better. Then, and not till then, can remedies receive their correct amount of attention.

A British Trade Delegation to Russia.

Evidence accumulates to confirm the views repeatedly expressed here regarding the desirability of British manufacturers and traders devoting attention to the Russian trade situation. A good deal of electrical information will be found in the Electrical Review volumes of the past year or two which may be of practical utility even now, in spite of its apparent lack of value when published. Since the publication of our leading article on "Electrical Trade with Russia?" (Elec. Rev., December 7th, 1928, p. 965), indicating American electrical activity, the chief event that has taken place, so far as we know, is the meeting of manufacturers and others which was held in London on February 5th, at which it was resolved to arrange for a representative delegation to proceed to Russia not later than March 8th. The visit is to be paid as the result of an intimation from the Russian Government that it would welcome such a delegation. The concerns which were represented at the meeting are in the main well known substantial industrial companies and associations. From the engineering and associated industries there are such names as Armstrong-Whitworth, Mather and Platt, Clayton & Shuttleworth, Ruston & Hornsby, Ransomes, Sims & Jefiries, Stewarts & Lloyds, Beardmore, Dunlop Rubber, the Associated British Machine Tool Makers, and the Society of Motor Manufacturers and Traders. It is stated in one paper that a representative of Callender's and the Anchor Cable companies was present, also Mr. George Balfour, M.P., and they add to the electrical character of the meeting. That the delegation should have a good quota of electrical men is appropriate in view of the great chance that electrical equipment may have of meeting the deficiency of technical productive capacity in Russia which we have commented upon in our articles. There is already some British electrical activity in Russia and possibly more than we think. At any rate, there is still time for more British electrical manufacturers or their associations to be identified with the visit and show enterprise in this latest export trade move. The delegation is being organised by the Anglo-Russian Committee, of 4, Dean's Yard, Westminster.

An engineer experienced in Russian affairs is reported in one of the advertising journals as stating that from information lately received, very large Russian orders for hydro-electric equipment and engineering supplies could be placed in this country almost immediately if business relations could be re-opened.

The result of the investigations of the delegation will be awaited with keen interest.

Applications of Coloured Light.

Dr. L. C. Martin's paper on the above subject, read in London recently at a meeting of the Illuminating Engineering Society, touched the fringe of a most fascinating subject. Much of the paper was concerned with physical problems, such as colour-measurement, nomenclature, and the design of a satisfactory standard of "white light"; but the author did not allow his audience to forget that the study of colour really rests on physiological phonomena, some of which were very strikingly illustrated by Mr. C. F. Smith's demonstration of mutochrome apparatus. Colour-photometry, colour-matching, and the uses of "artificial daylight" are closely related to these physiological aspects. It was not surprising that a considerable part of the discussion was devoted to these problems. Are we, or are we not, to imitate daylight in artificial lighting installations of the future? There seems to be some justification for the impression that modified artificial daylight is restful for the eyes, though the exact explanation is obscure; but a certain degree of care is needed to prevent the sensation of "coldness," and no one would suggest that lighting in future should consist in a slavish imitation of daylight. In certain arts, those of the theatre and the picture palace, for example, coloured light has special opportunities, for in such cases the novelty of the effects and the contrast with everyday conditions enthrall the senses. Illuminating engineers can do good service by devising more flexible and efficient methods of obtaining coloured light in abundance; but it will be agreed that the application of coloured light in the manner suggested above is an art, rather than a science, and those speakers in the discussion who contended that the successful production of pleasing colour-harmonies and contrasts is chiefly a matter of taste and artistic instinct were right, for no system based on mathematical formulæ, or physiological laws, can act as a substitute.

Electrical Research Finance.

Prefacing his reply to the toast of "The Institution of Electrical Engineers" at its largely attended annual dinner last week with the announcement that H.R.H. the Prince of Wales had consented to become an Honorary Member, which honour all sections of the profession and industry will appraise at its true value, Lieut.-Col. K. Edgcumbe, T.D., R.E.T. (Ret.), needlessly apologised next day at the luncheon of the British Electrical and Allied Industries Research Association for being on his legs again so soon; his happy manner of address always assures him a ready hearing, and in any case he rose to plead on behalf of a cause which no one can afford to neglect.

With its 16 main sections and 64 technical committees, the E.R.A. has during its eight years of existence won the recognition and wholehearted support of all grades of engineers and associations connected with the electrical industry, yet the Association has failed to attract sufficient financial support to enable it to tackle adequately the problems which confront it. While the Association has been able during the past year to maintain its expenditure without drawing upon its reserves, to remain within those bounds it has been again necessary to delay, and even to postpone indefinitely well-considered programmes of work, capable of bringing as good returns to the industry as any hitherto undertaken.

The rate of progress in any enterprise depends largely on the rate of expenditure: no section of the industry has benefited more from the work already completed than the electricity supply section, the investment in which cannot be much less than £300,000,000, its gross annual revenue being £45,000,000. As Mr. C. P. Sparks observed, would one-tenth of one per cent. of that sum be missed? Yet, if contributed to the E.R.A., it would provide all the funds needed for a full programme. Strange, indeed, how eager we are to commend, and withall how niggardly with the means of producing that which we can commend!

Water-Power in Tasmania.

The Waddamana electricity supply undertaking of the State Hydro-electric Department has a plant capacity of 66,000 h.p.

THE Hydro-Electric Department of Tasmania was established for the purpose of controlling all the water power of the State, constructing hydro-electric works and operating them after construction. A survey of the State has resulted in a number of schemes being projected, with a total capacity of about 600,000 h.p., of which the Waddamana undertaking, of 66,000 h.p., is in operation and the Shannon station is under construction.

The Waddamana scheme operates from the Great Lake of Tasmania, which has an area of approximately 60 sq. miles and an elevation of 3,360 ft. above sea level. The Great Lake is dammed by means of a multiple-arch concrete wall, fig. 4, which is claimed to be one of the largest of its type in the world. There are 27 arches, each of 40-ft. span, the central arches being 40 ft. high above the outlet sill level. Near the centre the structure is screened to protect the actual outlets from drift wood, and so on, and the outlets themselves are operated from behind the dam. The tops of the beams shown in the illustration rising above the water in front of the dam are the remains of an earlier dam now submerged. The lake is now full to within a few feet of the top, and contains three years' supply of water as an insurance against drought. Something like 1,150,000 acre-ft. of water is impounded.

The water from the lake is conveyed to the head of the pipe-lines leading to the power house by means of a canal 3½ miles long. At the near point in the illustration, fig. 2, the canal is 60 ft. wide at the bottom. The small "falls" along the canal were necessitated by the steep slope of the ground, as without them the water would flow fast enough to destroy the banks and bed of the canal. About 600 cu. ft. of water is passed by the canal per second, and the water is actually discharged into a lagoon of about 350 acres in extent, from which the pipes lead off. This lagoon acts as a settling basin, removing from the water grit which would injure the turbines, and also allows the turbines to take as much water as they require without regulating the head gates of the canal.

Fig. 1 is a view looking down the pipe lines, showing the power house and the tail race in the distance. The

Fig. 1.—Pipe Line, looking Down.

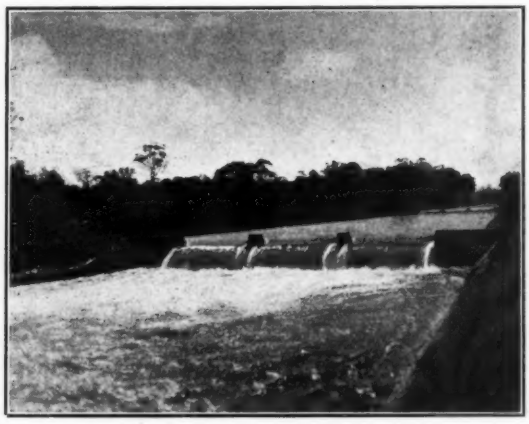


Fig. 2.—The Waddamana Canal.

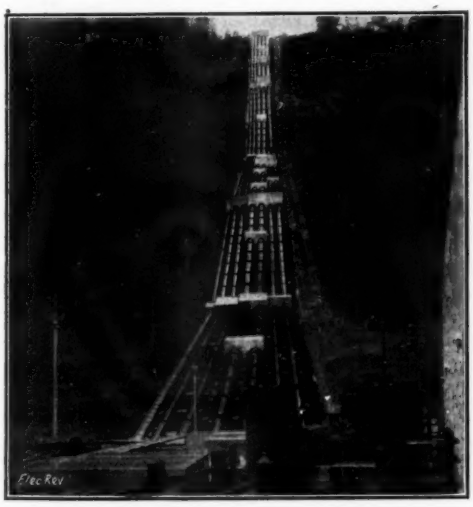


Fig. 3.—Pipe Line, from Station.

Fig. 4.—The Great Lake Dam.

two steel pipes on the right were installed in the early stages of the scheme, the other three pipes being added later. One of these is of wood stave construction and held together by screwed steel bands; this construction was necessitated during the war, when steel pipes were not procurable. All the pipes are laid above ground to facilitate inspection and repairs. The steel pipes are laid on concrete piers, and the wood pipe on wood logs spaced 4 ft. apart. The scattered houses shown comprise the village of Waddamana. Fig. 3 is a view of the pipe-line, looking upward. The large pipes at the lower end, where the water pressure is 500 lb. per sq. in., are 4 ft. in diameter and of metal 1 in. thick. All the pipes join into one common bus pipe 3 ft. in diameter, just visible on the right-hand side of fig. 3, where is also depicted the power-station wall. The bus pipe is equipped with the necessary valves, which are operated from the wood platform. The pipes are anchored at various points by means of concrete blocks.

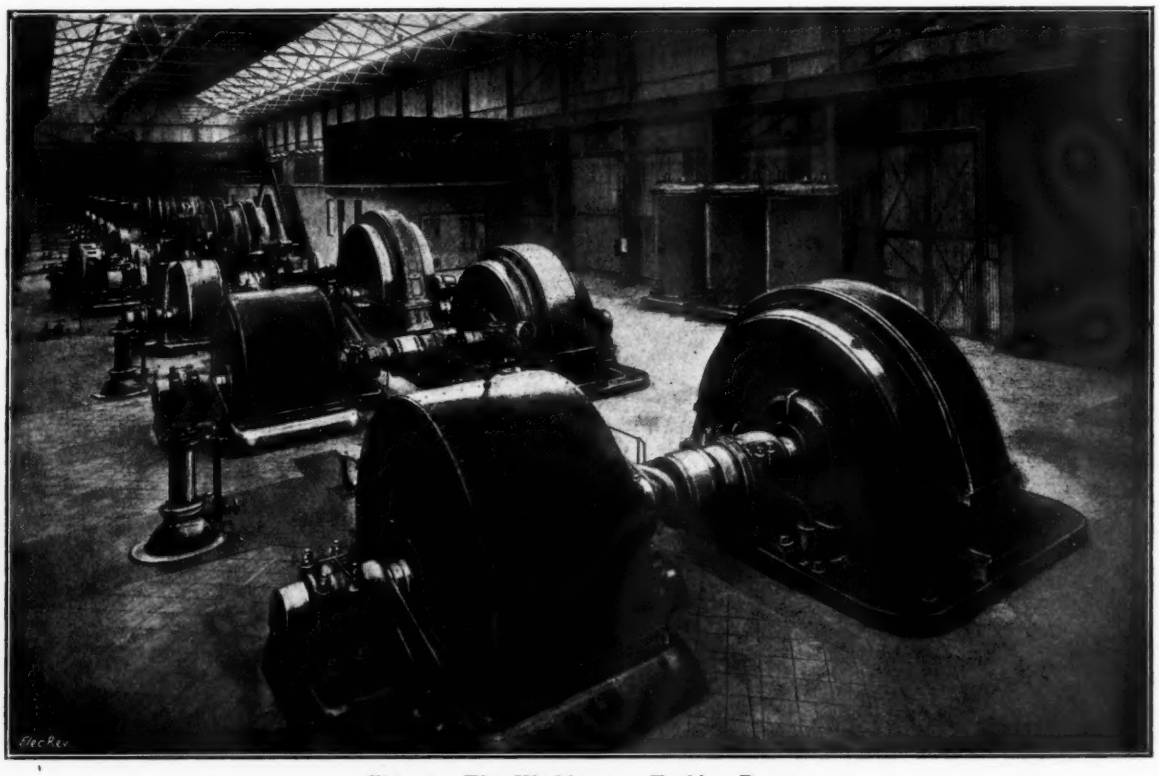


Fig. 5.—The Waddamana Turbine Room.

The power station is equipped with nine turbine sets, fig. 5, which operate under a head of 1,120 ft. There are seven 8,000-h.p. double-jet Pelton-wheel turbines, coupled to 7,050-kVA alternators, and two 5,000-h.p. single-jet Pelton-wheel machines, coupled to 4,050-kVA alternators. The turbines were supplied by Messrs. Boving & Co., Ltd., the larger alternators by the General Electric Co., Ltd., and the smaller ones by the old

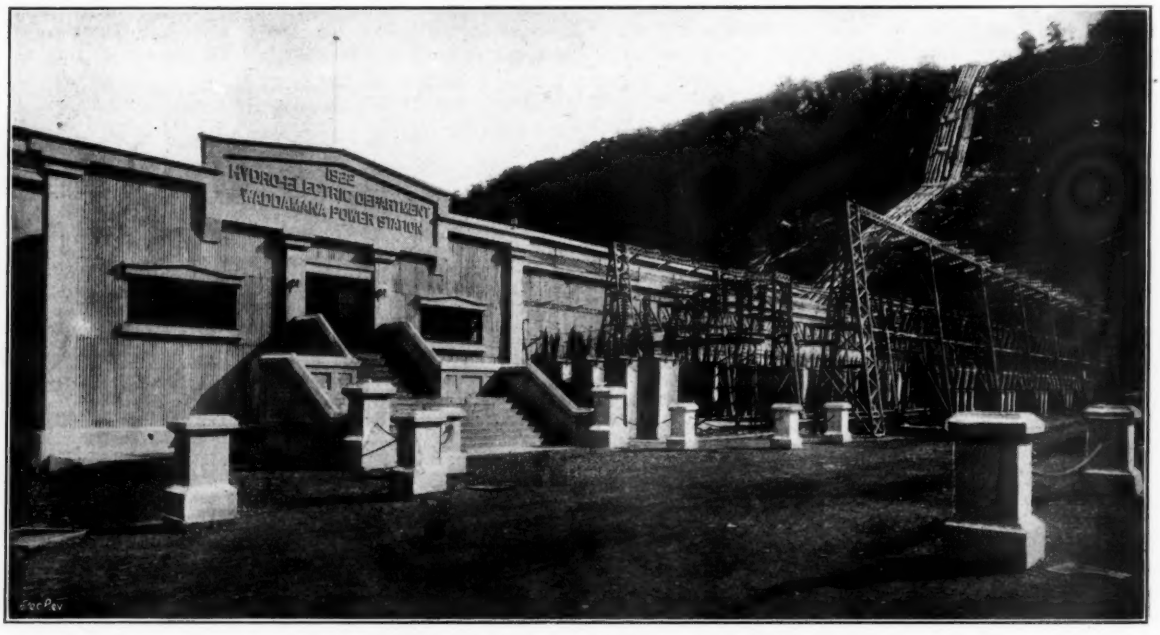


Fig. 6.—Station Exterior and Outdoor Sub-station.

British Westinghouse Co. The machines run at 375 r.p.m. and generate at 6,600 V, 50 cycles, 3-phase. The equipment is controlled from the glassed-in room shown in fig. 5, back left. A 25-ton electric crane serves the turbine room.

Fig. 6 is an exterior view of the station, showing the outdoor transformer and switchgear equipment by means of which the pressure is raised to 88,000 V for transmission. The power station is situated almost in the centre of Tasmania, and power is transmitted

Fig. 7.—88,000-V Transmission Line.

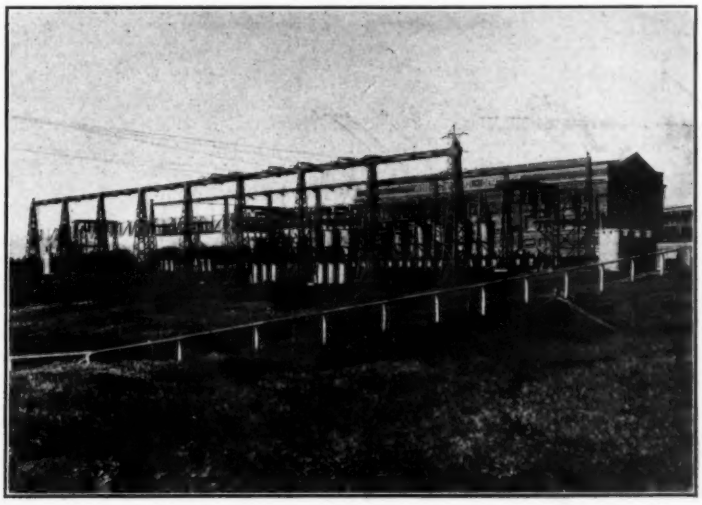


Fig. 8.—Risdon Sub-station; 55,000 h.p.

in the southerly direction by double-circuit lines carried on lattice steel towers to Hobart, a distance of 62 miles, and then a further distance of 15 miles to an industrial centre at North-West Bay on the River Derwent. Fig. 7 shows one of the transmission lines on the west side of the State. The Electrolytic Zinc Co. and the greater portion of Hobart and its suburbs are supplied at 11,000 V from a sub-station at Risdon, fig. 8, the terminus of the four 88,000-V lines going south. This "sub" has a capacity of about 55,000 h.p., and it supplies various consumers at 11,000, 6,000, 415, and 240 volts. Two 88,000-V lines also run northward, one terminating at Launceston and another at Railton in the north-west, and various feeders stretch out in all directions to the country districts where sufficient consumers are available. Power is delivered to the sub-station at Railton and stepped down to 22,000 V for delivery to Devonport, Sheffield, Penguin, Ulverstone and other towns. There is a further transmission line delivering power purchased from the Mount Lyell Mining and Railway Co. at 44,000 volts from Lake Margaret to Zeehan and Rosebery in the West-Coast District. A transmission line from Bothwell to Campbell Town, connected with the Great Lake scheme, supplies power to the midlands.

The maximum demand on the Waddamana plant in 1927 was 38,400 kW, the total connected load being 61,114 kW. The average load factor for the year was 94.2 per cent.

Among the many important industrial developments in Tasmania which are closely concerned with electricity supply may be mentioned the Mount Lyell mine where ore is obtained containing 0.5 per cent. copper, 1.5 ounces of silver per ton, and 0.04 oz. of gold per ton. Fig. 9 is a general view of Mount Lyell from the haulage summit. The haulage is used to transport the ore over the steepest part of the route, and a ground tramway line then takes the ore to the smelter. The haulage consists of a ground tramway track on which the trucks are raised and lowered by means of rope winding gear. The winding drums are driven by a 90-h.p. motor. One thousand tons of ore can be transported in 24 hours, the trucks being drawn at 1,000 ft. per min. Fig. 10 shows the Mount Lyell smelters where ore is treated. There are two or three blast furnaces which work intermittently. During 1926 nearly 45,000 tons of ore and concentrates were smelted. The photographs and most of the above information were supplied to us by Mrs. E. M. Storey, who has just returned from Tasmania, and their publication is made possible by the courtesy of Mr. G. H. Evans, electrical engineer to the Tasmanian Hydro-electric Department.

Fig. 9.—Mount Lyell Mine.

Fig. 10.—Mount Lyell Smelters.

Switchboard Instruments.

A Review of Modern Practice in the Design and Use of Indicating Electrical Equipment.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(*Concluded from page* 232.)

The overload capacity of the moving-iron instrument is probably greater than that of any other type, but the new induction instruments at least approach them, repeated overloads of a high order being insufficient to upset the calibration appreciably. In this connection it is of importance to note that moving-iron ammeters—as being more subject to overloads than voltmeters—can be made with a scale that is open at the middle of the range, and closes rapidly towards the top. If the normal load of a particular circuit is 100 amperes, an ammeter of range 0-200 A may be supplied which has its 100 mark at about three-quarters of the scale length, so that lower loads are read easily, and overloads up to 100 per cent. are still shown on the scale. This type of scale is most useful on circuits where overloads are prone to occur, and some makers make a speciality of this pattern. For fluctuations such as occur in power stations, this feature is certainly very desirable.

The range of a.c. instruments is probably not quite as wide as that of moving-coil instruments, except that the upper limits may be higher on account of the isolating properties of instrument transformers. For use with transformers, the standard ranges are 5 amperes and 110 volts, respectively, for an ammeter and voltmeter.* By this means a change of range is easily effected by exchanging the transformer, together with the re-scaling of the dial. Self-contained instruments are not usually easily altered, especially ammeters. A voltmeter may have its range increased, or decreased if it is not below about 50 volts, but ammeters are difficult to alter without fitting a new coil; generally it is best to return the instrument to the manufacturers.

Old types of moving-iron instruments were generally calibrated at, and supplied for a given frequency, and if for d.c. use as well they had two scales. Except for low-voltage ranges (say, less than about 50 volts), this practice is not now necessary, as any reputable ammeter or voltmeter is equally accurate over the usual power frequency range (25-100 cycles), and sometimes for d.c., but except in the case of recent instruments the latter does not always follow. Recent improvements, due to a large extent to the introduction of Mumetal or Permalloy in place of Stalloy for the iron in the field, have provided instruments which are of first-grade accuracy on d.c. as well as on a.c., and with the same calibration, and most makers are now producing or working on these instruments, but mainly for portable use at present, where the scope of multi-range and multi-frequency instruments is greater. For higher frequencies of the order of 300-600 cycles, such as are used for some radio transmitting stations, moving-iron instruments are possible, but they need to be calibrated at the working frequency, as eddy-current losses tend to become appreciable—as well as the increased hysteresis in the iron. The alternative is to use thermal instruments—preferably of the thermo-e.m.f. type.

Induction instruments will not read on d.c., and therefore must have a frequency error. It is not very great, however, over the usual limits of frequency variation, and with the new patterns on the market is negligible, especially for power-station switchboard use, where the frequency variation is generally very small indeed. For small isolated plants where frequency is not finely controlled, such as motor-alternator sets where the speed of the set, and therefore the frequency, depends on the load and other considerations, the frequency error of an old induction instrument may be more serious.

If a change of frequency is contemplated it is necessary to consider whether the instruments, apart from their transformers, will be suitable for the altered frequency. As the standard frequency in this country is 50 cycles, the required change would usually be either from 25 to 50 cycles, or 100 or less to 50 cycles; in either case a change of about two to one. With modern moving-iron instruments no alteration will be necessary, but very old voltmeters may need recalibration, especially if of a fairly low range. If induction instruments are in use they will be useless on the new frequency and are best dealt with by arrangement with the makers. They may possibly be used on an altered frequency if the range is changed at the same time, and in the same ratio, but this is rarely feasible, and is certainly a matter upon which the manufacturer should be consulted.

Dynamometer instruments should be quite satisfactory with an altered frequency.

Wattmeters are used extensively on a.c. circuits. They may be of the dynamometer or the induction type; the former is usually more accurate, but the scale arc is restricted to about 90 deg., and so where uniformity with long-scale (300 deg.) ammeters and voltmeters is required, the induction type has to be used. As for ammeters and voltmeters, until recently only second-grade accuracy was the best that could be attained, but now that improved induction wattmeters are available the type is reviving. Wattmeters are necessarily bulky, especially the three-phase pattern for unbalanced load, and it is doubtful if any instrument will be produced in the 3- or 4-inch size to match the small ammeters and voltmeters of those sizes which are used on some control boards.

Temperature and frequency errors can be reduced by correct compensation as for the corresponding ammeters and voltmeters, and the instrument transformers, if any, used with wattmeters need to have a lower phase-angle between primary and secondary vectors than can be the case for voltmeters and ammeters, which are unaffected by phase-angle errors. When installing wattmeters of fairly high voltage range without transformers, it is desirable to connect, if possible, so that the difference of potential between the current and potential coils is a minimum, to minimise electrostatic attraction between the coils.

Frequency indicators are necessary in any a.c. supply station, although only one or two are generally required. Recently a master-clock arrangement for maintaining a constant frequency has been brought out, and its adoption should proceed apace, as correct frequency is of great importance to interconnected stations. Deflectional frequency indicators are generally preferable to the reed type, mainly on account of their continuous scale, that of the reed type being essentially discontinuous; and for ease of reading, the

* Ratings from B.S.S. No. 81-1927.

scale of the deflectional type being more nearly like that of other indicating instruments in appearance. The limited range required, however, usually restricts the scale arc to about 90 deg., and there is thus no real scope for a very long scale, except, possibly, for laboratory use, where the frequency range to be covered may be between wide limits, and for portable instruments.

One or two synchroscopes in a station are all that are required, and it is preferable that these should be of a large size, and easily visible from a distance, if necessary. There is not much variety of type on the market; most are of the revolving-pointer type and intended for working in parallel with voltmeters across potential transformers. Lamps are useful as a stand-by, but are obsolete for all except the smallest installations or laboratories, and the question of synchronising "bright" or "dark" is by no means settled, both methods being advocated and in general use.

Power-factor indicators of the "complete circle" type are most used, the movement being unconstrained and capable of a full 360 deg. motion. They are especially useful for installations where a particular machine may generate or motor under certain conditions. These are essentially circular-dial instruments, unlike those of limited range, which are often of the edgewise type.

Graphic instruments on an a.c. switchboard are not numerous, as a rule, and are generally confined to one or more voltmeters, and, when called for, to wattmeters, both single-element instruments for single-phase and three-phase balanced load and double-element instruments for three-phase unbalanced load (sometimes used for feeders for recording the loading), reactive current indicators, for showing the wattless component, $EI \sin \phi$, as against the true watts $EI \cos \phi$, and to power-factor and frequency recorders.

Instrument Transformers.

The use of instrument transformers, for both current and voltage, is now so common that manufacturers provide numerous types and sizes for different purposes, and there is a British Engineering Standards Association specification defining their use (B.S.S. 81—1927.) Current transformers are used, not only for indicating ammeters, but for wattmeters, power-factor indicators, and relays, whilst voltage transformers similarly are used for wattmeters, power-factor indicators, frequency indicators, synchroscopes, and relays. Frequently a number of instruments, often a combination of the above, are operated by a single instrument transformer, to save expense. Where this is the case, it is necessary to choose a transformer of suitable "burden" or secondary load. Where integrating instruments are used it is often better to run them from separate transformers, and this is particularly the case if relays are used as well, as the alteration of volt-ampere burden due to variation in the position of the relay may interfere with the accuracy of a meter which may be used for revenue purposes.

The errors of instrument transformers are of two kinds, ratio and phase angle. For operating ammeters and voltmeters, and some types of relay, the ratio error only is of moment. For other instruments using a combination of current and voltage elements it is necessary that phase-angle errors are within certain limits .

For current transformers certain ranges are standardised, and the following are the standard ratings.*

Class "A."—Portable precision type, 7½ VA.

Class "B."—Switchboard and portable industrial type for close accuracy, 5 and 15 VA.

Class "C."—Switchboard and portable industrial type for ordinary industrial requirements, 5, 15 and 40 VA.

Class "D."—Switchboard and portable industrial type where phase-angle error is unimportant (ammeters, &c.), burden not exceeding 40 VA.

The usual frequency rating is 50 cycles; other frequencies are specially marked. If, however, it is required through change of station frequency or other reason to use a standard 50-cycle transformer on a different frequency, or a non-standard on 50-cycle the following may be considered. The change in burden is approximately proportional to the frequency, but at a reduced frequency the burden should be reduced still more, so that if a 100-cycle instrument transformer is to be used on a standard 50-cycle circuit it should supply a burden of not more than 40 per cent. of its original rating. Class "A" transformers thus have no applicability to switchboards, and Class "D" a very limited application, as the permissible errors are approximately equal to those of second-grade indicating instruments (for a.c.). Approximate figures are given later for the consumptions of various types of instruments for calculating the burden on a transformer. Ammeters and current coils are, of course, connected in series across the secondary of the transformer. The accuracy of current transformers is generally unaffected by change in frequency over the usual power range. Some makers refer to Class "A" or "B," &c., in different terms, but the above are the standard B.E.S.A. definitions.

On e.h.p. circuits where the transformer is for isolating purposes only it is necessary that the transformer should be able to withstand a high voltage between primary and secondary, and for this reason and because the primary should be of small reactance in order not to break down on short circuit, the use of straight-through or single-turn transformers is very desirable.

In the past it has not been permissible to use less than about 400 ampere-turns for a Class "C" transformer primary and 800 for Class "B," in order to maintain the accuracy, but lately transformers using nickel-iron cores have been introduced for very much smaller currents, and are satisfactory, where only an ammeter or an ammeter and relay are used. Class C is less suitable for use with instruments where phase-angle error is of consequence. In any case the difficulty of maintaining the accuracy as the primary voltage increases is greater, as although the pressure drop in the transformer is low, the insulation must provide for the full voltage to neutral of the system. This generally necessitates a larger core and consequent trouble due to stray fields, as well as extra losses due to the larger quantity of iron involved.

Voltage Transformers.

These are rated somewhat similarly to current transformers, the types being as follows:—*

Class "A."—Portable precision type, 10 VA, single-phase.

Class "B."—Switchboard and portable industrial type, 15, 50, 100, and 200 VA for single-phase and 25, 50, and 100 VA for three-phase.

Class "C."—Switchboard and portable industrial type, for ordinary and industrial use, burdens as for Class "B," above.

Class "D."—Switchboard and portable industrial use where phase angle is of no consequence and a large ratio error is permissible, no standard burden.

As with current transformers, Classes "B" and "C" have most application on switchboards. The frequency range of voltage transformers is limited, the standard transformer for 50 cycles not being suitable beyond the limits of 45 and 100 cycles.

A change of frequency from 50 to 25 cycles thus requires new potential transformers, but if from 25 to 50 cycles, as is more likely, the 25-cycle transformer will generally be suitable. The actual permissible frequency depends on the maker, and it is best to consult

* (Abstracted by permission from B.S.S. 81-1927, Instrument Transformers, official copies of which may be obtained from the British Engineering Standards Association, 28, Victoria Street, S.W.1. Price 2s. 2d., post free.)

the maker if a transformer is to be used on a frequency different from that marked on it, or 50 cycles.

Consumption of A.C. Instruments.

The actual consumption for any particular type varies widely with different makes, and different patterns by the same maker, so that only very wide limits can be stated here. More detailed figures are available, either from a manufacturer's list or from him directly. An approximate idea of the consumption of instruments is necessary when transformers are used, otherwise the consumption is immaterial. The rated burden (or load) of an instrument transformer is that at which the prescribed accuracy is obtained, with other fixed conditions. This burden may be increased by a considerable amount, but the accuracy then falls off somewhat. The following consumptions are representative:—

Moving-iron voltmeters, about 4-10 volt-amperes per 110 volts; ammeters up to about 300 amperes, about 2-4 volt-amperes; induction voltmeters 3-15 volt-amperes per 110 volts; ammeters 5-12 volt-amperes for a 5-ampere instrument; dynamometer voltmeters, ammeters, and wattmeters, consumption depends entirely on the range, being as large as 100 volt-amperes for a range of a few hundred volts.

The consumption of different types of relays varies considerably, and the following table is based on B.E.S.A. specification 142—1927, Electrical Protective Relays:—

Type	Over-current or under-current.	Over-voltage or under-voltage, at 110 volts.
Induction	20	—
A.C. other than induction .	0·15—20	20
D.C. moving-coil	0·2 volt on shunt	5
D.C. motor pattern, 5 amperes, instantaneous	0·2 volt on shunt	—

A.C. DIRECTIONAL RELAYS WITH VOLTAGE WINDINGS.

Type.	Current winding.		Voltage winding.	
	Voltage compensated	Non-voltage compensated	Voltage compensated	Non-voltage compensated
A.C instantaneous or time lag	3	2	25	15
A.C. combination of over-current and directional relays	10	6	25	15

The figures refer to volt-amperes, and are per phase in the case of polyphase relays.

Electrolytic Copper Extraction.

Some Notes on Modern Current Theory and Practice.

(Specially Contributed.)

THE current arrangements required for the electrolytic extraction of copper have changed considerably since the introduction of the process, although the basic principles remain unaltered. Electrolytic processes are now used for extracting copper from alloys and waste material which previously were regarded as being unworkable. Poor ores which required very complex treatment can now be successfully handled by an almost direct system, and it is claimed that before long electrolytic processes will supplant all others, both for efficiency and for economy. The following notes relate to the current employed, after the raw material has been suitably treated.

To produce good copper, the solution must circulate as rapidly as possible, since the metal deposited at the cathode is purer and more malleable the more actively the liquor is circulating. When the solution is not in motion, it becomes richer in copper at the anode, but poorer at the cathode. The poor solution rises in the bath, and thereby a layer of liquor offering great resistance is introduced into the circuit; in this way an opening is made for other metals to be separated along with the copper. The solution diminishes in conductivity (as it becomes neutralised) at such a rate that with unaltered conditions and using electrodes two inches apart, the difference of potential in the bath may rise from 0.1 volt to 0.25 volt. Foreign metals interfere with the reaction, and the current density no longer suffices to decompose completely the copper solution in the required manner, a certain proportion of cuprous oxide being deposited at the cathode. This is remedied when the solution is acid, as the oxide is redissolved and again deposited by a secondary reaction; neutral solutions, however, leave this deposit in the copper on the cathode, and hence the product remains less pure.

A table has been compiled for electrolytic operators, showing the influence of the solution upon the difference of potential in the bath.

Regarding the relation which exists between strength and voltage of the current, the same weight of copper is deposited by a current of high strength and low voltage, as by one of low strength and high voltage, the ampere-hours remaining unchanged. The current density per square yard of electrode in present-day practice is about ten times what it was when the process was introduced, and it is greater for a pure copper anode than for an impure one. Liberal allowance has still to be made when calculating the energy required, as losses arise from various causes.

By theoretical calculation there should be one ounce of copper deposited per ampere-day, but in practice the actual amount is much less. This is due to the redissolving of some of the deposited copper, short-circuiting, and leakage to the ground. Up to about 1 per cent. of copper is lost by re-solution of the cathodes; leakage losses are about 1 per cent., and short-circuiting losses about 5 per cent. of the total. On the average, the efficiency of the current is between 90 and 95 per cent.

The total tank resistance is the subject of controversy between numerous electrometallurgists, but is generally accepted as showing about 60 per cent. for the electrolyte, whilst the metallic resistance and contacts make up the remainder, including about 5 per cent. for counter electro-motive force.

The number of baths to use, and their dimensions, can be selected to correspond to the current strength and voltage, after the production and power have been determined experimentally. The volume of the baths can be calculated when the distance between the electrodes is known. In each bath the surface of the electrodes is the quotient of the total current strength by the current density.

Originally very-low-voltage dynamos only were used, but these have been superseded by machines having a voltage upwards of 200 volts. These necessitate the use of a purer anode copper and continual purification of the electrolyte. With low-voltage machines short and thick leads are required, and the operations generally are much more liable to be disturbed by any undue

increase of resistance in the baths than where higher voltages are employed.

There are two main systems used in the electrolytic refining of copper: the parallel and the series. These correspond to the arrangement of the electrodes and the claims made for the parallel system are that it is applicable to all grades of copper, permits of the use of both high- and low-current densities in lead-lined baths, and can be conducted with a minimum loss of current.

In the best series systems at present in operation, the quantity of copper in the baths is smaller, which is an advantage over the parallel system. The electrodes are not so massive, and are placed closer together; the copper dissolves more rapidly, and the whole plant is smaller. Against the series system may be pointed out the necessity of using good copper and electrodes, which must be rolled. The voltage between anode and cathode must be high, and the loss of electrical power is considerable. Owing to the high voltage and the risk of short-circuiting, the usual lead-lined baths cannot be used, and where wood baths are substituted they are readily worn out of commission. With the parallel system, the tanks are constructed of various dimensions, but the bottom must be far enough below the lower ends of the electrodes to prevent any short-circuiting through the deposited mud. The cathodes are smeared with oil, paraffin, or petroleum ether and the edges with paraffin to facilitate the removal of the deposited copper.

The points of contact must be above the surface of the liquid or protected from the electrolyte by a layer of paraffin. For many different current-densities employed it has been found most satisfactory to use electrodes two inches apart, which distance appears to be generally accepted throughout the world at the present time.

Catalogues.

The Author considers that their First Essential is Convenience both for the Estimator and for the Buyer.

By H. R. TAUNTON.

FEW business firms require and receive more catalogues than electrical contractors. From alternators to zincs, from silk shades to telegraph poles, their needs on occasion are all those of the builder, the furnisher, the civil engineer and a dozen other trades. Of necessity they are always asking for catalogues; and for every one they ask for they receive a score unasked. Every morning's post is heavy with them. Encyclopædic catalogues, under whose impact the wicker of the waste-paper basket squeaks in protest; expensive catalogues, whose consignment to it wrings the frugal soul; artistic catalogues, cheap and nasty catalogues, catalogues fat, and thin, and limp, and squat, of every size and shape; all the small fry of pamphlets, folders, leaflets, circulars and posters; they are doomed, nine out of ten of them, to the same inglorious end—the dustbin.

A certain number of them the contractor must keep. He must therefore adopt a process of rough selection, and the net result follows the great law of the survival of the fittest. Now, since every maker or factor who issues a catalogue does not do so to amuse the leisure of his publicity man or to foster the printing trade, but in the hope that it will bring him orders; and since that hope is contingent on its being kept and used; it is clearly of importance to him to know, and to embody in it, those points which will secure it the greatest expectation of survival. Those points are not those which delight the compiler and the printer, such as artistic paper and type, or original details of design and format, but only the two points which appeal to the user: utility and convenience.

The point of utility need not be discussed. Naturally every publisher of a catalogue considers it not merely useful but a necessity; and naturally, too, he uses a certain discrimination in issuing it. He does not send price-lists of turbines to a tobacconist, or of electric fires to a gas company. He sends them to those whom he thinks most likely to buy the goods he sells. The final arbiter, however, is the man who receives it. An electrical contractor will not keep a catalogue of saxaphones. He may or may not keep a catalogue of electric signs, but he is more likely to discard it until he has a definite inquiry. He will welcome almost any fittings catalogue, because he is always lending them and losing them. For the rest, what he keeps and what he throws away is largely a matter of inertia. The new catalogues of firms with whom he usually deals go to his shelves as a matter of course, and long custom or trade friendship may induce him to use them even if they are badly compiled. The catalogues, too, of well-known firms, whose goods are commonly specified, he will generally keep, if only for reference. But for the others, innumerable, only those have any chance of survival which can make an immediate appeal by their obvious convenience, just as, out of the many salesmen who besiege him, only the ready and informative have any chance of a useful hearing.

A convenient catalogue, one which is kept and used, is in effect the manufacturer's best salesman. In these strenuous days any contractor to whom it is worth sending an expensive list works under the constant pressure of the clock. He has not time to waste in searching for a price-list which by reason of its faulty make-up has lost its place on a crowded shelf; nor having it, can he afford minutes to find the particular item he needs. Of several catalogues dealing with similar goods he will tend more and more to use that which jumps most readily to his hand, and in which he can find most quickly what he wants, with all its relative information.

This is more particularly the case in the estimating department. When he has secured an order the contractor can afford the little time needed to weigh the merits of competitive makes against their prices. When he is estimating, working feverishly against time, he will, as far as possible, use only those lists with which he is familiar, which will give him the information he wants in the least time and with the least trouble. In other words, he will use the most *convenient* catalogues. Then, having adopted a certain maker's patterns and prices in his estimate, he will more often than not follow the line of least resistance when he secures the contract, and place the order with the same maker. From the maker's point of view, to have his products included in a contractor's estimate is half the battle (so far as that particular contractor is concerned). It follows, then, that those makers will get the best return on their publicity expenses who compile their catalogues with an eye to the convenience of the estimator.

Take, for example, cables. The first manufacturer who thought of issuing a net price-list of standard types of cables conferred an inestimable boon on estimators,

saving them the laborious calculations of pounds-per-mile to pence-per-yards, with a couple of discounts. His example has been followed by all the other cable makers, and no contractor now uses their larger catalogues except for special types of cables. Their net price-lists are all very much alike; but each estimator uses that only with which he is most familiar—to him the most convenient—and almost invariably he orders, when the time comes, from the firm whose list he used. With a standardised article such as cable there is no reason why he should give his choice a second consideration. The same principle applies in varying degrees to other goods. The estimator uses that catalogue which he personally finds the most convenient, and naturally turns first to the same catalogue when he has to place an order.

What, then, constitutes that "convenience" which so appeals to an estimator? The question may be considered under two heads: convenience in filing, and convenience in use.

The manufacturer who wants his publications kept must make them easy to keep. Awkward shapes and sizes, and eccentricities in format, are a nuisance on a bookshelf. Folios and sexto-decimos, narrow books and books broader than they are high, which will not keep their dressing in the row, are anathema; as are the anæmic volumes which persist in losing themselves between the pages of a stouter neighbour. On the other hand, such a massive tome as that issued by one of the leading firms, though useful for occasional reference, is useless to an estimator because it is too heavy to be easily handled.

There is no reason why catalogues should be of more than two sizes, quarto and octavo; and of these the latter is the more convenient. It depends, of course, on the amount of matter to be listed, but generally a stout octavo is better than a flabby quarto. And the only excuse for any size smaller than octavo is that the matter is insufficient to make a reasonable number of pages in the standard size, *e.g.*, in the case of the net price-lists mentioned above.

Next in importance is the binding. Thin paper covers are useless; or any cover which will not stand the hard usage of a busy office. Every catalogue should have a binding, whether boards or cloth or manilla, stiff enough to allow it to stand on its own bottom. A thin quarto which collapses as soon as an adjoining volume is removed, infallibly gets crumpled under it when it is returned, or else crushed out of sight behind it.

Again, if the back of the book is not wide enough to carry a title, as is often the case, some other means of distinguishing it at a glance is essential. Nothing is more irritating to a hurried user than having to finger a shelf-full of slim, neutral-tinted booklets which can only be told one from another by examining their covers. Something more original than the usual browns and greys is wanted; and such devices as a different coloured stripe or a projecting tab quickly impress themselves on the memory of the user.

In short, so far as convenience in filing is concerned, the publisher's aim should be to ensure that his catalogue will stand stout and upright where it is put, and be easily found there when it is wanted.

Turning next to convenience in use, his aim should be to assist the estimator to find quickly the item he seeks, give him succinctly all the information he needs about it, with price and discount, and offer him, if he wants it, any possible alternatives. That sounds very obvious and simple, and yet how many compilers fail in it. (I should like here to pause and praise the few who succeed, and I should love to pillory some of the many who don't; but as I should certainly get for my pains more bricks than boxes of cigars, I resist the temptation.) No two catalogues of accessories, for instance, agree on the sequence in which their items are listed: in many, indeed, it is hard to trace anything which could be called a sequence. I have in mind one catalogue in which the arrangement has evidently been dictated solely by the size of the blocks. There are, of course, certain classes of goods where any rational sequence is difficult—but there is always the alphabetical on which to fall back. An index is no substitute for a definite, easily-remembered arrangement. Indexes, indeed, are essential, both numerical and nominal—and how often one or both are missing!—but the hurried user will not refer to them if he can avoid it. He usually finds it quicker to flip over the few pages where what he wants ought to be. And if he can't do that, he tends to use some more convenient catalogue.

Anything, therefore, which will assist his search counts enormously towards the efficiency of a price-list. In the case of a bulky catalogue, a thumb index, tabs, or tinted sections are useful as minimising the original defect of bulk. Clear type, liberal spacing and bold headings—which should be at the outer edges of the pages—all help. Most of all do illustrations help. There can hardly be too many: not only for the information they convey, but for the aid they give in finding their attached letterpress. A picture of a lampholder not only gives at a glance more detail than a page of print, but it catches the hastening eye in a tenth of the time it takes to apprehend the title, "Lampholder." Economy in blocks is fatal to the chances of a catalogue. Everything that can be illustrated should be illustrated, in all its varieties—and not with the block made for the pattern of the year before last!

Finally, when the required item is found, comes the important point of its price. One would think that nothing could be simpler than to attach a plain and unequivocal figure to every article listed. Even the untutored costermonger can do as much for the bananas on his barrow but not the average compiler of an electrical catalogue. Some tabulate their figures horizontally, others vertically, many both ways, at hazard—with catalogue numbers strewn erratically among them. The illustration may be at one corner of a page and the price at another, or even on the opposite page. One well-known maker of accessories, whose list is well compiled and illustrated, refers the estimator to a separate booklet for his prices. Nearly every maker insists on pricing all but the largest items in quantities: in hundreds, grosses, or dozens. They argue that the buyer commonly buys in quantities—or they would like him to. The wise contractor, however—particularly in London—prefers to buy no more than his exact requirements; and the estimator, whom we are here considering—and the catalogue compiler is not—almost always wants a price for odd numbers. Why should he be put to the trouble of the extra calculation?

That brings us to the question of discounts. Pricing an estimate from catalogues is a long whirl of mental arithmetic. The discounts vary with the catalogues; in some—necessarily in factors'—they vary in different sections. One or two of them offer a code against each page or item; others carelessly refer the user to a separate table. None takes any further trouble to relieve him of the irksome and recurrent labour of reducing their printed figures to actuality.

I believe the E.C.A. is averse to any extension of the practice of the cable makers in issuing net price lists. Their argument is that they may fall into the hands of non-trade users. Why should they any more than do the cable lists? What layman, for instance, is likely to ask to see a conduit list? In certain cases, admittedly, it would not be so easy to divorce the prices from the full descriptions—say, in the case of fittings—but some compromise might be attempted. It would be something if the compilers left a definite space opposite each figure where the estimator could write the net figures as he calculates them. As it is, he jots them down as best he can in the margins—and quite callously, by the way, takes the risk of his secrets falling into the hands of the uninitiated.

Let us suppose, after so much criticism, that the contractor has a selected library of good and useful catalogues. Then arises the problem of keeping it up to date. A very difficult problem. It is one primarily for the publisher, torn between efficiency and economy. He should not expect any help from the user in its

solution—why should the buyer in an open market help the seller in his selling?—and yet he persists in doing so. A universal electrical provider sends him sectional reprints and asks him to remove the old from their elaborate folder and bind in the new. Folders, apart from their defect of bulk, have the further defect that they handicap classification. A folder containing sections dealing with switchgear, fittings, wireless, and what not, belongs nowhere; whereas, divided, each section can be filed in its appropriate class. A manufacturer of switches and wall sockets sends him a bundle of loose leaves and expects a typist to be detailed for an hour's work in placing them. A firm of conduit makers sends a sheet of revised prices which can only be folded up and placed in the covers of his catalogue, whence—if it ever gets so far—it is presently lost. Yet others send, every few weeks, folders, leaflets and printed slips, with or without adhesive, to be fixed in their scattered publications. To cope with the daily "literature" in a busy contractor's office on the lines confidently suggested by its senders would mean the half-time services of an intelligent clerk. All these attempts of makers to keep their catalogues up to date without going to the expense of a complete reprint depend on the co-operation of the users; so they are doomed to failure. The average contractor has not the time to act as an honorary librarian, and, if he had, he has not the inclination. He has the average human component of inertia, and he finds it easier to use the waste-paper basket.

The manufacturers' point of view demands a certain sympathy. He cannot be continually issuing new editions of his catalogue with every new development and every fluctuation in price, yet at the same time he must supply his customers with the latest information about them. He will not, however, satisfactorily or permanently solve the problem by any means which puts a tax on their energy and goodwill. His best chance, as things are, is to secure that goodwill by a catalogue which may so far work its way into their favour as to induce them to take a little—but only a very little—trouble with it: the trouble, for instance, of handing it to a representative who would then and there make the necessary revisions in it; or of returning it, facilities being provided, in exchange for a corrected copy. That would entail on the publisher a certain amount of work—but it would be no more than he now expects his customer to do for him.

It would cost him something, too; but little more than his present methods, and there would be a known return for it. That little more, and something over, he could save by cutting out all the odd magazines, booklets, folders and pretty-pretty publications with which he now overwhelms us. An excellent thing, postal publicity, but to-day a little overdone. The bulk of it is waste paper and serves rather to irritate than amuse us. We can, if we choose, ignore a newspaper advertisement, but we are put to the trouble of handling and disposing of the rubbish which clutters our mail. Certainly to electrical contractors one good catalogue—that, I repeat, means a catalogue designed as much for the estimator as for the buyer—is worth a year's output of the "literature" of the whole electrical trade. That doesn't appeal to the busy estimator. What does, is a catalogue which saves him time and useless work. And the buyer follows in his footsteps.

The South Wales University.

Some Electrical Features of the Laboratory and General Equipment at the New University at Cardiff.

THERE are some interesting points in connection with the electrical installation at the new South Wales University, at Cardiff, which has now been in operation for some months, and has, it is claimed, fulfilled all the requirements and given every satisfaction.

The new buildings, which were designed by Mr. W. D. Caroe, comprise physics, chemistry, botany, veterinary and agricultural laboratories, in addition to a lecture theatre, workshops, professors' rooms, and so on. The whole of the buildings and equipment are on the most modern and up-to-date lines, and are believed to form one of the finest laboratory blocks in the country.

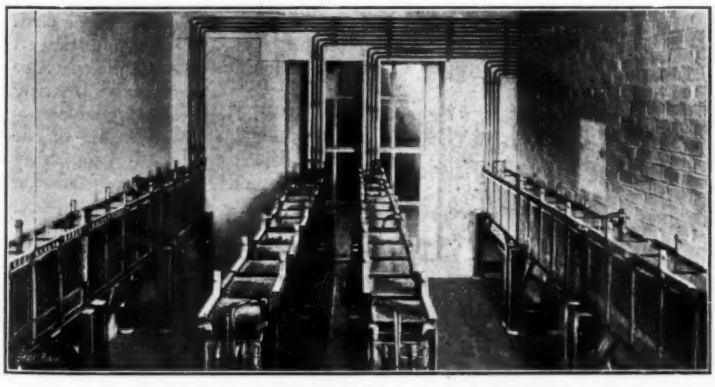


Fig. 1.—Physical Laboratory Battery.

The general electrical installation, which was carried out under the supervision of Mr. S. E. Thornton, includes circuits for lighting, power, ventilating, lifts and the experimental section, current for which, both a.c. and d.c., is obtained from the Cardiff Electricity Department. V.i.r. cables in solid-drawn conduit with iron-clad switchgear, switches, and plugs, are used throughout, with the exception of the Memorial Research Block, where, owing to the nature of the experiments carried out—magnetic research—the wiring is partly lead covered and partly v.i.r. in heavy-gauge copper tube, with phosphor-bronze boxes and wood-cased switchgear.

The centre of electrical interest is the experimental section, in which, for the Physics Department, is the following equipment: a Pritchett & Gold battery consisting of 14 banks of 5 cells of 250 ampere-hour capacity each; a 10-kW motor-generator for charging two or more banks of cells; a booster for charging individual banks of cells; and a main switchboard, laboratory exchange switchboards, and terminal connecting boards. Fig. 1 is a view in the battery room, showing the cell runs. These are served by 7/.064 twin "Maconite" cables supported on porcelain button insulators affixed to a teak facia board.

The main switchboard, which was manufactured and erected by Messrs. A. Dean & Co., Ltd. (the contractors for the whole of the electrical installation) under the supervision of Messrs. Arthur Ellis & Partners, consult-

ing engineers, is, it is claimed, practically fool proof, and designed for extreme flexibility. It is of the open type, 22 ft. in length, and contains control panels for the motor-generator and booster, reception panels for the d.c. and a.c. mains supplies, and main distribution panels. The board is designed to enable two or more banks of cells to be charged from the motor-generator, or from the d.c mains supply through a variable resistance, and for charging single banks of cells from either the booster or mains supply.

Fig. 2.—Main Switchboard, Motor-Generator and Booster.

Change-over switches are provided to enable current to be taken to the laboratories from the battery, or direct from the generators or mains supply, both d.c. and a.c., at one and the same time, and at any voltage from 2 to 250 V. Each bank of cells is connected to two pairs of heavy terminals on the board, and connection is made to the outgoing terminals by means of heavy rubber-covered flexible leads, the necessary voltage being obtained by closing the single-pole series switches. Fig. 2 is a view of the main switchboard, depicting the method of connection by the flexible leads, and also of the motor-generator and the booster. The distribution to the laboratories is by means of thirty-two pairs of 7/.052 cables, each protected by a d.p. switch and fuse, terminating in an exchange board. These exchange boards, which vary in size according to the requirements of the laboratory in which they are fixed, are equipped in a similar manner to the main distribution switchboard panels, and in all cases the number of outgoing pairs feeding the terminal boards is at least twice the number of the incoming pairs from the main switchboard. This provision is made as it frequently happens that two or more students at one time carry out similar experiments. Interconnections are made by means of rubber-covered flexible leads as previously described.

The chemistry department is equipped with a similar installation, but on a smaller scale, which consists of a 2-kW motor-generator, a 60-Ah battery, and a main switchboard, comprising motor-generator control panels and distribution panels, together with a subsidiary panel for charging portable accumulators—which are used by the Professors for research work—from either the motor generator or mains supply. The operation of this switchboard is on similar lines to that in the physics department, as described above.

An interesting view of one of the physical laboratories is given in fig. 3, which indicates, as does the other illustrations, the particularly neat general wiring, and shows some of the special switching arrangements. On the left side of each of the two rear "pillars" is a variable-voltage connecting board, while 5-A lighting plugs are arranged on the fronts of all three pillars. The wall plugs at the back are for lighting and d.c. and a.c. power, respectively.

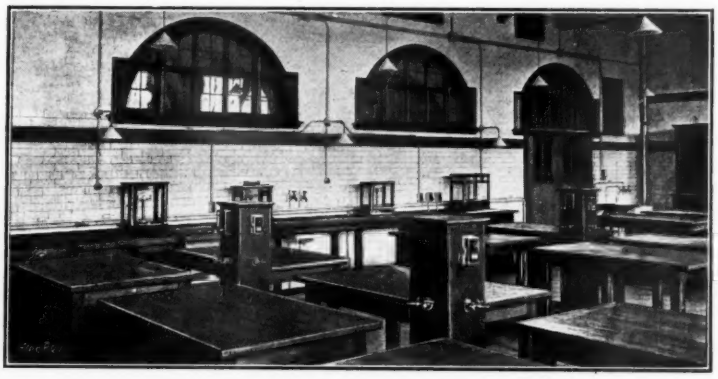


Fig. 3.—One of the Physics Laboratories.

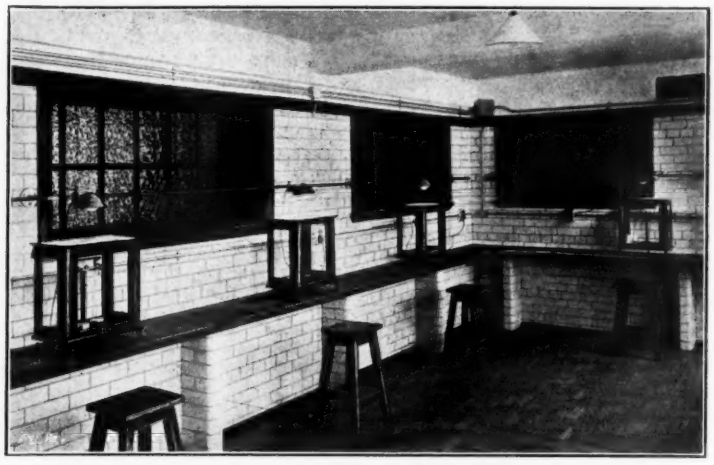


Fig. 4.—Corner of Balance Room.

Fig. 4 shows a corner of one of the balance rooms, and an interesting feature is the specially designed sliding lighting fittings.

The motor generators were supplied by Messrs. H. J. Scott & Co., Ltd.; the switchgear by Berry's Electric, Ltd.; fuse boards by Messrs. J. H. Tucker and Co., Ltd.; conduit, General Electric Co., Ltd.; cables, Hackbridge Cable Co., Ltd.; switchplugs, M.K. Electric, Ltd.

We are indebted to Messrs. Dean and Co. for the above information and illustrations.

The Principal of the new college is Dr. A. H. Trow, F.L.S., and the heads of the physics and engineering departments, respectively, are Dr. H. R. Robinson, Ph.D., and Dr. A. J. Sutton, M.B.E.

Legal.

Attorney-General v. London and Home Counties J.E.A.

THE hearing of this action, in which four London electricity supply companies sought to restrain the defendant Authority from expending funds in the promotion of a Parliamentary Bill, was reported in our last issue. On February 6th Mr. Justice Astbury gave judgment. He said the Bill which the defendants were promoting sought to extend the district set up by the scheme so as to include any further areas in the administrative counties of Buckingham, Essex, Hertford, and Surrey, and part of the county of Sussex. It also sought to transfer to them the rights of local authorities to purchase the whole or any part of the undertakings authorised by the Electricity Acts and Orders, and to give the defendants several powers in excess and in contradiction, as he held, of the provisions of the scheme. The relators were authorised undertakers in their respective districts and were liable to contribute towards the administrative expenses of the defendant authority. The defendants had no electricity undertaking at present and had no revenue except the contributions to their administrative expenses payable by county councils, the railway companies and the authorised undertakers in the district. The defendants had contended that there was an implied right in the Authority to take proceedings for the purpose of obtaining an Act or a Special Order and to spend their money in doing so. In his opinion the section of the Act they relied on gave nothing of the kind. He had come to the conclusion that the Bill was one which the defendant authority had no power to pay for out of its funds; and it had no right, in his judgment, to levy upon its constituent members the costs of promoting such a Bill which many of its members strongly opposed and which, if the matter went through, they would have to pay for both with regard to its promotion and their opposition. The Bill appeared to be outside the purposes of the defendants' scheme, and it could hardly be incidental to those purposes. So far as the district and the powers of the defendant authority were concerned they were fixed and determined by the Order incorporating the Authority and by the scheme. The attempt to prove that there was some implied authority from expressions in the Act or scheme, outside the express authority in the Act, had entirely failed. The result was that he must grant the injunction as asked.

Clarke v. Greene.

MR. JUSTICE EVE, in the Chancery Division on February 8th, appointed a receiver of a business of electric lighting engineers carried on at 518, Leadenhall House. The appointment was made on the application of the plaintiff in a partnership action —Clarke *v.* Greene. Mr. KNIGHT, for the plaintiff, said the terms of the agreement of partnership were that the defendant should find the necessary capital and that plaintiff should devote himself to the work of the business at £5 a week salary and expenses, and the profits were to be shared in certain proportions. The partnership business went on until the beginning of this year, when the relations between the parties became strained as the result of the refusal of the defendant to join in opening a banking account, and ultimately defendant took exclusive possession of the premises, of which he was only a joint tenant with plaintiff, and the latter had not been allowed access to the place. Defendant issued a summons against the plaintiff at the Mansion House for "fraudulently converting" three cheques, and the magistrate adjourned the summons till the present application came before this court.

Mr. SWORDS, for the defendant, said the business was to proceed for a year, after which the question of partnership was to be discussed. The banking account was operated on by defendant, and plaintiff never asked for a joint account to be opened. Defendant put into the business approximately £400. It came to his knowledge that plaintiff had been collecting sums due to Clarke & Greene for goods supplied, and had converted certain monies to his own use. The business had been carried on at a loss, and if a receiver was appointed it meant that the defendant would have to pay for him. Plaintiff had no interest in the assets.

Mr. KNIGHT said that plaintiff denied that he had appropriated money and not accounted for it.

His LORDSHIP said he would appoint a receiver, but he would not allow the plaintiff to nominate him and would refer the matter to chambers and the receiver would be nominated by the defendant.

Welding Machine Patent Appeal.

ON February 6th the Court of Appeal reserved judgment in the appeal of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., against a decision of Mr. Justice Eve in favour of the respondents, the Rose Street Foundry and Engineering Co., Ltd. The action, which concerns a welding-machine patent, was reported in our last issue.

Llandudno Tramway Co. Fined.

AT Colwyn Bay on February 6th the Llandudno and Colwyn Bay Electric Railway Co. was summoned by the Colwyn Bay Council for failing to maintain in proper condition the roadway over which its cars run. It was alleged that accidents had occurred as a consequence of the bad state of the track. Mr. J. A. Brodie, Liverpool, said that the condition of the track was very bad indeed, and ultimately the company would have to put in a much better foundation. A solicitor for the defence said that as the track was laid in a private road, the company could not be proceeded against under the Order on which the Council relied.

The magistrates fined the company £5 upon each of the two charges brought and 10s. per day during the continuance of the offence. They also ordered the company to pay counsel's fees amounting to 25 guineas.

Institution of Electrical Engineers.

Annual Dinner and Reunion.

THE annual dinner of the Institution of Electrical Engineers, the total membership of which has now reached 13,305, was held at the Hotel Cecil, London, on February 7th, Lieut.-Col. K. Edgcumbe, T.D., R.E.T. (Ret.), the president, being in the chair. Supported by past- and vice-presidents and members of Council, he presided over a gathering which numbered about 650 members and distinguished guests, who included representatives of the principal scientific societies, engineering institutions, and kindred bodies.

Lieut.-Col. C. B. LEVITA, C.B.E., M.V.O. (chairman, London County Council), following the loyal toasts, which were proposed by the chairman, in asking the company to drink to the continued success of the I.E.E., referred to its wide and varied activities. English people lacked somewhat that "boosting" attribute which was so noticeable a characteristic of some other peoples; nevertheless, they could take credit for electrical engineering if for nothing else. Electrical progress owed much, he observed, to improved educational facilities, for they had produced a body of intelligent people who could handle the scientific implements provided by engineers. Referring to the increasing use of electric light, heat, and cooking on L.C.C. housing estates, he said it had reached 7 kW per tenement in some cases.

The PRESIDENT'S announcement that H.R.H. the Prince of Wales had consented to become an hon. member of the Institution was received with enthusiasm: those who had heard his speech at their dinner two years ago had been struck, he recalled, with his insight into matters electrical, and all would be grateful to him for his continued interest and the honour he had done all members of the profession.

Replying to the toast, the President pointed out that civilisation took different forms at different periods; to-day it was obsessed with a desire for speed, all bustle and hurry, and the only things that saved them were electrical aids, methods, and labour-saving devices. The average cost of electricity was now slightly lower than the pre-war figure, in spite of the fact that that of coal was 80 per cent. higher, which was an index of what the engineer could do if left alone without too much interference from the human element. His interest had recently been aroused by the Board of Trade cost-of-living index, so far as it concerned fuel and light: he found from the figures that that item was recorded as being 70 per cent. above its pre-war cost. As electricity was cheaper now than it was before the war, he investigated, and inquiry led to the discovery that the Board had apparently never heard of electricity, for the only fuel and means of producing light it credited the man-in-the-street with using were coal, oil, candles, and gas! "I venture to think it is about time the Board revised that index," commented the Colonel.

Mr. W. B. WOODHOUSE (past president) toasted the guests, remarking that there were those amongst them who controlled mighty means of communication; the recent decision of the Governments of the Empire in that respect was of vast importance. They were also honoured with the presence of Mr. P. Bunet, president of the Société Française des Electriciens, which had invited the I.E.E. to hold its summer meeting this year in France.

The EARL OF CLARENDON, D.L. (chairman of the British Broadcasting Corporation), in returning thanks on behalf of the guests, said he believed that one in every three households in this country was equipped with some form of broadcast radio-telephone receiving set; some 25 to 30 million people indulged in listening, and about half that number were regular listeners. He believed that the forces which made for discord would soon recognise that in wireless they had a most formidable and relentless foe; before long "nation would speak peace unto nation."

Mr. H. T. TIZARD, C.B., F.R.S. (secretary of the Department of Scientific and Industrial Research) also responded, expressing his gratitude for the assistance that the cause of research had always received from the Institution.

During and after dinner a programme of music was performed by the British Imperial Orchestra, and the reunion in the Victoria Hall afforded an appreciated opportunity of renewing acquaintanceship and strengthening friendship.

The Electrical Research Association.

The Eighth Annual Luncheon.

FOLLOWING the eighth annual general meeting of the British Electrical and Allied Industries Research Association on February 8th, a somewhat formal function of short duration, the annual luncheon was served at the Savoy Hotel, London, Mr. C. P. Sparks, C.B.E., M.I.E.E., president, occupying the chair; members and guests numbered some 170.

LIEUT.-COL. K. EDGCUMBE, T.D., R.E.T.(Ret.), president of the I.E.E., after the loyal toast had been honoured, proposed the continued success of the E.R.A., expressing his unbounded faith in research. It was the only really safe investment, for money spent on it was sure to be returned; nevertheless, it was extraordinarily difficult to persuade people to give money. At the annual meeting that morning Mr. E. B. Wedmore, director and secretary, had pointed out that if they could charge commission on the savings that resulted from research they would have an enormous income. Of the saving effected he estimated that 75 per cent. was derived by the public, 20 per cent. by the electricity supply industry, and the remaining 5 per cent. by manufacturers; as the supply section stood to benefit so largely, it was fitting that Mr. C. P. Sparks had been persuaded to accept the presidency.

MR. C. P. SPARKS, C.B.E., M.I.E.E., in responding, appealed for more financial support, observing that, in round figures, £160,000 had been expended during the last eight years, an average of £20,000 a year, the present rate of expenditure being some £25,000 per annum. The real investment was represented by a much larger figure, as it was supplemented by the valuable services of some three hundred voluntary workers and the use of plant and facilities afforded by some of the large supply undertakings and manufacturers. The main results so far secured were primarily of value to the electricity supply section of the industry: those results had effected a saving in capital expenditure, maintenance, and running cost of the supply undertakings. The annual saving arising out of the work of the E.R.A. from the following seven researches was estimated as already saving a figure approaching one million pounds per annum. The seven researches referred to were those on underground cables, insulating material, insulating oil, dielectrics, overhead transmission, switchgear and control apparatus, and steam turbine nozzles. This country lived by export trade, and, owing to the high standard of living, high wages, and heavy taxation, overseas sales were dependent on producing the best article; thus, any development which tended to improve their knowledge and place them ahead of other countries was of vital importance.

The scale of operation at home being small, compared with some of the great world undertakings, it might be expected that their delegates attending international conferences would take a secondary position, but, through the work of the E.R.A. and associated bodies, the position of engineering delegates representing this country had been greatly strengthened and, as a result of first-hand information, has enabled them to take a leading position held by no other country, and, in general, the opinion of our delegates had been endorsed by those international conferences. This must be a factor in expanding overseas trade, while, from a personal point of view, the attention paid to the views of their delegates made him proud of being an Englishman.

The last report of the Department of Scientific and Industrial Research recorded that certain researches of the E.R.A. had been "curtailed, or suspended, for lack of the necessary funds." That had been the position for the last two years, and the 1928-29 programme, involving an expenditure of £36,000, which the staff organisation was well able to handle, had been curtailed to some £25,000. To meet the whole position an important conference was held in June last with Sir Richard Glazebrook in the chair, who asked: "Is it to go on? Is it to go on with increased means? Has it proved of sufficient value to the industry, to the country, to the users of electricity, and to practically all of us, to make it worth while that that scheme of work which has been developed during the past six or seven years should be continued on a larger scale than before, with more full and more complete support from the various branches of industry?" Important resolutions were passed at that conference, amongst others to recommend (*a*) extension of the present scale of expenditure (£25,000 per annum) and to double it within five years; (*b*) to widen the Articles of Association to give adequate representation to all contributing interests, and the whole matter was now under consideration by a committee representative of all the interests concerned. From the conference of last June £50,000 per annum should be found within the next five years. In 1928 some £5,000 (1-5th of their income) had been derived from the supply section of the industry, the E.R.A. being supported by statutory undertakings which supplied 95 per cent. of the energy sold. While the proportion which should be found by each section of the industry was now the subject of inquiry by a committee appointed last June, he could not but feel that the supply section (subject to adequate representation on the Council) should find a much greater proportion in future. The investment in the electricity supply industry at home was over £300,000,000; the gross revenue was some £45,000,000 per annum, and if 1-10th of 1 per cent. were contributed to the E.R.A., it would have all the funds necessary for a full programme. Any such expenditure by supply undertakings would ultimately be met by the public, who would be recouped by improved service, increased reliability, and ultimately lower cost.

MR. R. W. PAUL, M.I.E.E., chairman of the E.R.A. Council, asked the company to drink to the health of the chairman. He thanked Mr. Wedmore and his staff for their past work and drew attention to the dependence of the future upon the attitude of the electricity supply industry. One's sense of fairness and generosity generally consisted of 50-50; if the supply section would assist to the extent of 50 per cent., the Association would no longer have cause to worry about cheeseparing.

The chairman returned thanks.

Reviews.

Matter, Electricity, Energy: the Principles of Modern Atomistics and Experimental Results of Atomic Investigations. By W. GERLACH, translated by F. J. FUCHS, Ph.D. Pp. xii+427; figs. 119. London: Chapman and Hall, Ltd. Price 30s. net.

Professor Gerlach is one of those physicists who are able to transfuse into their writings some of the enthusiasm and almost divine curiosity without which research is impossible, and it is obvious why his book, in the German, has come into wide use amongst advanced students. There is probably no other in existence which could serve as a better introduction to the original literature. The material dealt with in its thirty chapters touches upon the majority of the important experimental researches made between the discovery of the electron and the time of publication (August, 1926), and the controversial points which have inevitably to be introduced, such as the question of the existence of sub-electrons, and the still unsolved problem of the origin of the discrepancies between the Cambridge and Viennese radioactive measurements, are presented and assessed in an unbiased and perfectly fair way. It is impossible to refer here to all of the sections individually, but the titles of a few chapters, Super-conductivity, Crystal Conduction, Infra-Red Frequencies of Chemical Radicals in Crystals, The Physical Basis of Photochemistry, Ionisation in Chemical Reactions, Chemical Reaction by Electronic Impact, and Photochemical Catalysis, for example, will probably appeal to anyone taking up the book, as they do to the reviewer, as subjects about which they have often wished to know more, but for which they have been unable to spare the time necessary to arrive at the essence of the detailed original publications. Two chapters are also of some technical value: Structure Analysis by X-Rays (XXIII) includes descriptions of several bulbs (one due to Prof. Gerlach himself) which can be constructed readily in a laboratory workshop, whilst Practical Applications of the Photoelectric Effect (XX) bears the stamp of being written from experience. Mathematical derivations have been avoided throughout. In fact, the only fault to be found, but that unfortunately a serious one, is in the way that Dr. Fuchs has made the translation. His English does not run fluently, and his choice of words (*e.g.*, "Mix Crystals" on page 353, and "Experimentation" on page 147) is often most irritating. Anyone who is unable to read the German, and who takes up the book in its present form, must be prepared for these imperfections, but we believe, nevertheless, that he will be amply repaid and stimulated in its perusal.

K.G.E.

Heaviside's Electrical Circuit Theory. By L. COHEN. Pp. ix+169; figs. 28. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

Heaviside's contributions to electromagnetic theory have been notoriously neglected, probably because he was both mathematician and physicist, but too loose in his ideas for the former and too abstract for the latter. H. Jeffrey's Cambridge Tract constitutes a sort of belated apology for this from the one, and it will not be Prof. Cohen's fault if this book of his does not make Heaviside's methods a common working tool of electrical engineers. The value of the methods lies in their wide applicability; a single broad principle, that of applying operational methods without initially questioning their validity, suffices for the solution of a whole set of problems which would otherwise have to be attacked, each by the special appropriate analysis.

Prof. Cohen's book falls naturally into three parts. Chapter I is a general introduction to the operational calculus; Chapters II and VII develop the expansion theorem; and Chapters III-IV are mainly concerned with applications of the latter to typical electrical problems. The first section, although it already takes the reader a long way, and contains several important fundamental conceptions, such as that of the "unity function," is really subsidiary to the second. In this, Prof. Cohen first derives the expansion result by a method of his own (Chapter II), and then obtains it by Heaviside's reasoning

(Chapter VII). Prof. Cohen's method is direct and simple to follow, and makes use of the resolution of the expression for the current into a series of partial fractions; he does not consider the special case when two or more of the roots of the impedance equation happen to coincide, but these will be readily understood by reference elsewhere, once the case of unequal roots has been mastered. Heaviside's derivation, on the other hand, does not appear to be stated completely in any one place in his publications, but Prof. Cohen has been able to show that, contrary to an opinion sometimes expressed, he did give a formal but scattered proof, based on general considerations of the dynamics and energy of an electromagnetic system; the appropriate quotations, together with Prof. Cohen's comments upon them, constitute Chapter VII, and are a valuable piece of historical research. The remaining chapters, on applications of the methods, particularly of the expansion theorem, are both examples in these, and valuable in themselves. The importance of electrical filter circuits (III), ocean cables (IV)—perhaps the main interest of Heaviside himself—the more general cases of propagation over transmission lines (V) and over artificial lines (VI) need not be emphasised here. As already pointed out, the results can be obtained in a variety of other ways, but by Heaviside's way they are obtained in a connected manner.

There is an appendix which includes a note on Bessel functions, a list of useful mathematical formulæ, and abbreviated tables of the Bessel, exponential, hyperbolic and error functions. We have noted a few typographical errors, but these are almost inevitable in a semi-mathematical treatise, and we can unreservedly concur in the opinion expressed by Prof. Pupin, in a foreword, that "Dr. Cohen's presentation of this subject is so clear that many of the difficulties which the student finds in Heaviside's original work have disappeared." Dr. Cohen is to be congratulated on having made a valuable addition to the electrical engineer's library.

K.G.E.

Wave Mechanics and the New Quantum Theory. By A. HAAS, Ph.D. Translated by L. W. CODD, M.A. Pp. xviii+124; figs. 3. London: Constable & Co., Ltd. Price 7s. 6d. net.

This book is Prof. Haas's "Materiewellen und Quantenmechanik," amplified in some few points to allow for advances between the appearance of the German edition (February, 1928) and the completion of its English equivalent (July, 1928). The author's preface states that it aims to appeal "to the layman as well as to the professional physicist," and anyone who has read other books by the same writer will not need further incentive to take up this one; Prof. Haas is almost as well able to make mathematical physics intelligible as Prof. Sommerfeld himself.

After starting off with a few preliminary remarks on the nature of the special problems presented by atomic physics, Chapter I proceeds to the need for a new quantum theory occasioned by the difficulties in that of Bohr and Sommerfeld. Chapters II, III and IV give the development of the ideas of de Broglie, and include statements of the principles of Fermat and Maupertuis, and of certain parts of the theory of relativity, as well as giving a derivation of the expression for the group velocity of waves travelling in a dispersive medium. Chapter V is an interpolation on experimental results, giving, in bare outline, the work of Davisson and Germer on electron diffraction from nickel, and that of G. P. Thomson and of Rupp on diffraction by transmission through thin foils; readers of the ELECTRICAL REVIEW should perhaps be warned not to attach too great weight for the present to the results of Dymond on electron scattering by helium, which have recently been called into question, but any who have lingering doubts as to the wave nature of the electron must have them immediately dispelled if they look at Kikuchi's recent beautiful mica diffraction photographs in the *Tokio Proceedings*, which appeared too late, unfortunately, for inclusion in Prof. Haas's book. Chapter VI again takes up the theory, now in the form of Schrödinger's generalisations—analogous to the transition from geometrical optics to physical optics—and we find the mathematical basis of quantum numbers in the characteristic values of differential equations; in Chapter VII these are applied to some particular problems. Chapters VIII-XI are an introduction to the matrix mechanics of Heisenberg, Born, and Jordan, connected formally with the wave-mechanics of Schrödinger, and having the far-reaching implication that "causality can only be accepted for statistical probabilities, whilst for the elementary processes of physics it must be denied" a matter further discussed in the last chapter (XVI), where we find it stated that ". . . it does not appear possible to give . . . elementary particles either a definite localisation or a sharply defined boundary"; and "A question . . . is that of whether there is in Nature any other kind of regularity than the purely statistical. . . ."

The actual development of quantum statistics occupies three of the remaining chapters, Pauli's principle of the unique assignation of quantum numbers being extended in the ways proposed by Bose and Einstein, and by Fermi. To anyone who would question the value of this apparently abstract work we would point out that in the hands of Sommerfeld it has already led to a solution of most of the outstanding problems connected with the electrical resistance of metals. The other chapter (XV) is concerned with miscellaneous applications of the new work. There is a chapter synopsis at the beginning of the book, a list of symbols, one of constants, and a bibliography, besides the usual indexes.

Quantum theory is not an easy subject—nor, for that matter, is Newton's theory of gravitation, or many other more familiar branches of physics. We believe, nevertheless, that Prof. Haas's presentation of its newer developments is not likely to be improved upon, and that it should open up an otherwise inaccessible field to anyone who has a pass knowledge of mathematics. Its philosophical aspects alone are sufficiently important to justify the spending of time in reading the book. Mr. Codd's translation is excellent.

K.G.E.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Heating Houses Electrically.

A new system of heating houses, the invention of Mr. Chester I. Hall, an American electrical engineer, has been given a trial in Fort Wayne, Indiana, U.S.A., this winter, and is reported to have been successful. According to the *Wall Street Journal*, the system is said to be adaptable for hot air, hot water, and vacuum forms of house heating, and operation is entirely electrical and automatic. Steel cylinders (their size and number depending on the radiation area to be served), filled with water and equipped with large "hot points," form the basis of the system, a sheathing of five inches of asbestos with "Johns-Manville" wallboards on the outside forming the enclosure; further equipment consists of a pressure regulator, electric fan, pump, control box for "night" and "day" temperatures, master fuse, and meter. In the living part of the house the only equipment is a small thermostat, by which the householder controls his day and night temperature during the heating season. In the case of a hot-air system, the usual two or more cold-air registers lead to a point outside the heater, where an electric fan is installed, and automatically controlled to operate at below the temperature desired and to stop running when that is reached. The revolving fan opens a shutter arrangement in the wall of the heater, and the inrush of cold air starts hot air circulating through the house. The hot air is contained in the compartment throughout the night, or "off peak" period, heating the water in the cylinder by the "hot points." The clock arrangement automatically starts the "hot points" functioning at night, usually about 10 p.m., and stops heating about 6 a.m. The heated water is supposed to be sufficient to supply hot air for 16 hours, the thermostat automatically bringing the house temperature up to the day range at whatever hour in the morning the clock is set for heating. In the case of a hot-water system operation is somewhat different: the electric clock and thermostat controls for day and night ranges of temperature and use of electricity are the same, but the outlet valve has an ordinary plumbing trap to prevent natural circulation and over-heating; a centrifugal electric pump connected to the return pipe starts pumping water through the system by thermostat control, circulating hot water until the temperature reaches the desired figure, and then it automatically stops pumping. Each radiator is equipped with a thermostatically-controlled flapper valve, to prevent overheating the radiator. The company which supplies the electricity has worked out contracts for house-heating and hot water on a yearly basis, which is equivalent to one cent a kilowatt-hour. The house-heating season runs from October 15 to May 15th, and 50 degrees temperature for eight hours and 70 degrees for 16 hours a day (during zero outside temperature) during the season are guaranteed; the hot-water contract covers the entire year. The electric control of the heating system is so fixed that electricity is used during the period of the smallest demand on the power station (10 p.m. to 6 a.m.) The cost of heating a house of seven rooms and a bathroom and supplying constant hot water works out at $210 a year. A low "off peak" rate is possible under these conditions.

A New Electric Iron.

The "Type Two" electric iron, fig. 1, is a recent introduction of the TELEPHONE MANUFACTURING CO., LTD., Hollingsworth Works, West Dulwich, S.E.21. It is strongly built and cleanly finished with heavy nickel plating, including the flexible cord connector. Among the features which are claimed to assure easy working are the rounded corners at the point and heel of the under surface. The design of

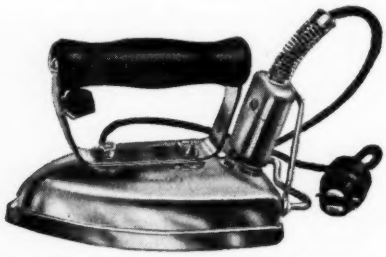


Fig. 1.—"Type Two" Electric Iron.

the special heating element ensures, it is claimed, a high degree of reliability. A 8½-ft. length of flexible cord and the necessary connectors are supplied with the iron. The apparatus weighs 5 lb., and is supplied for standard voltages up to 250 V. The loading is 400 W.

A Large Cooking Installation.

At the Public Hospital, Wellington, New Zealand, has been installed an electric baking oven and a large island kitchen range to cater for its 600 or so patients. The apparatus selected was from the "Magnet" equipment manufactured by the General Electric Co., Ltd. The result of the installation, which has now been working for nearly six months, has been a remarkable improvement in the cleanliness and in the cooking of the food, and complete satisfaction to the cooking staff. One feature which has won unqualified appreciation as opposed to the old coal-fire ranges, has been the absence of soot and grime within the kitchens, and this factor alone, it is estimated, represents a saving of approximately £20 a year for repainting. In June the ovens were inspected while in actual operation by 25 engineers representing electricity supply authorities from all over New Zealand, and the demonstration given on that occasion was a most satisfactory one. The accompanying illustration, fig. 2, shows the kitchen range.

Fig. 2.—Kitchen Range Installed at Wellington, N.Z., Hospital.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Our Foreign Electrical Trade.

The following table shows the value of exports and imports of electrical goods and machinery during January:—

	Jan., 1929.	Inc. or dec. as compared with Jan., 1928.
	£	£
Exports.		
Electrical goods and apparatus ...	950,862	+ 5,251
Machinery	5,077,573	+272,590
(Including electrical machinery) ...	663,439	+ 62,359
Imports.		
Electrical goods and apparatus ...	441,441	+ 16,783
Machinery	1,627,372	+282,803
(Including electrical machinery) ...	156,654	+ 8,558
Re-exports.		
Electrical goods and apparatus ...	11,012	− 3,021
Machinery	123,689	+ 487
(Including electrical machinery) ...	8,555	+ 411

Metro-Vick Social Work.

The annual gathering of the committees engaged in social or welfare work at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., took place in the M-V Club Hall on February 4th. This was the twelfth gathering, and 25 committees were represented, indicating the amount and variety of work of this nature which is carried on. The chair was taken by Mr. G. E. Bailey (director), supported by Mr. A. McKinstry (director); the chairman of the company, Sir Philip Nash, was also present. The orchestra, the male voice choir, and the dramatic society provided items of entertainment, and an abstract from the report of each committee was read. Mr. G. E. Bailey, in a short speech, thanked the members of the committees for the voluntary work they were doing, which did so much to keep up the good spirit which pervaded the organisation. Sir Philip Nash congratulated the members of the committees on the good work of the past year, and pointed out the necessity of further fostering the spirit of goodwill in order that it should spread throughout all the branches of the new amalgamation into which the company had now entered. He particularly stressed the necessity for more export business. Mr. Ritchie, as president of the M-V Australia Works Welfare Association, compared conditions in Australia with those in this country, and mentioned that he intended to interview some of the members of the various committees, and see what he could learn that might be useful when he went back to Australia. Mr. McKinstry also congratulated the committees on their activities, and said that the sales side was aware that it could not be successful unless the goodwill and good work of the whole organisation was behind it, and he believed the spirit fostered by the social and welfare committees was a great asset to the company.

Callender's Hospital Fund.

The annual meeting of Callender's Hospital and Distress Fund was held at Belvedere on February 2nd. Mr. J. F. Watson presided, and the 26th annual report which was presented showed total receipts of £1,505 (including £55 brought forward, and an expenditure of £1,441, leaving a balance of £64. Grants were made to 16 hospitals and institutions and assistance was afforded in about 300 cases.

United States Electrical Exports.

During November last electrical goods and machinery valued at $10,851,811, were shipped from the United States, bringing the total for the first eleven months of 1928 up to $100,474,387 (against $92,290,548 in January-November 1927). The figure for November, 1927, was $10,062,204. The principal increases during the month occurred in the following items:—D.c. generators under 500 kW, from $85,875 to $135,121; self-contained lighting outfits, from $96,035 to $131,469; flashlight batteries, from $222,573 to $333,267; watt-hour and other measuring instruments, from $17,049 to $117,310; stationary motors, 1 to 200 h.p., from $313,671 to $449,544; domestic heating and cooking devices, from $136,989 to $193,374; radio apparatus, from $1,259,764 to $1,629,451; ignition apparatus, from $128,694 to $225,008; and refrigeration sets, up to one-ton capacity, from $328,067 to $799,872. There were several large decreases, including the following:—D.c. generators, 500 kW and over, from $243,981 to $48,764; a.c. generators, 2,000 kVA and over, from $277,602 to $23,196; steam turbo-generator sets, from $109,112 to $50,419; switchboard panels, from $230,396 to $110,883; switches and circuit-breakers, over 10 A, from $278,682 to $147,659; mining and industrial locomotives, from $128,794 to $26,065; and industrial electric furnaces and ovens, from $139,459 to $20,820. The outstanding features of the figures for the first eleven months of last year are the rises in the value of exported refrigerators, up to one-ton capacity, from $3,315,044 to $5,907,409; and of radio apparatus from $8,147,650 to $10,639,755. The principal customer during November last was, as usual, Canada, her share amounting to $3,364,612. The next in order were Argentina ($799,549), Australia ($772,801), the United Kingdom ($639,359), Mexico ($507,457), and Cuba ($424,113). The imports of electrical goods into the States during November were valued at only $365,443, the largest item being lamps ($213,375).

A Long London Lift.

What, it is claimed, will be the longest lift in London, has just been ordered by the Westminster Cathedral authorities, to convey sightseers from the ground floor to the upper platform of the tower, a distance of 185 ft., in a little over half a minute. The makers are Messrs. MARRYAT & SCOTT, LTD. The upper platform of the tower is one of the highest vantage points in the Metropolis accessible to the public. The lift will provide accommodation for ten passengers, who will be saved the effort of climbing over three hundred steps.

The East African Electrical Market.

In the course of a report on the trade and commerce of East Africa (Department of Overseas Trade. Published by the Stationery Office, 2s. net), Mr. C. Kemp, Deputy Trade Commissioner at Nairobi, says that in electrical and industrial machinery and internal combustion engines, British manufacturers are holding their own. Austria and Czecho-Slovakia have entered the market for electric lamps, against Dutch predominance, and from different Continental sources there have been offers of cables and general accessories which are reported to be somewhat below ruling British prices. Appendixes to the report give some particulars of the electrical import trade. In the first six months of 1928 Kenya and Uganda imported electrical goods and apparatus valued at £22,420 (against £16,420 in the first half of 1927). Of this Great Britain supplied £16,560 (against £9,977) and Germany £1,322 (against £880). In the same period the Tanganyika Territory imported goods valued at £11,650 (as compared with £8,452), Great Britain supplying £10,507 (against £7,132), and Germany £915 (against £971). Zanzibar's imports were valued at £10,210 (Great Britain £8,755, Germany £993), against £1,865 (Great Britain £635, Germany £942). During the whole of 1927 Northern Rhodesia imported electrical machinery to the value of £128,052 (Great Britain £124,595, United States £2,337), as compared with £25,024 in 1926 (Great Britain £17,782, United States £5,778).

Local Exhibitions.

ASHFORD (KENT).—An electrical exhibition was opened on February 7th under the auspices of the Ashford Circle of the British Electrical Development Association, in conjunction with the local branch of the Electrical Association for Women, members of which gave cooking demonstrations. The exhibition was opened by Mr. E. E. Hoadley, borough electrical engineer of Maidstone.

BRADFORD.—The exhibitors at a Better Housing and Housekeeping Exhibition which was recently held at Bradford included the Gem Labour Saving Device Co., Ltd. ("Ohio" and "Gem-de-Luxe" vacuum cleaners); Messrs. F. Grandison & Co. (radiators); Frigidaire, Ltd. (refrigerators); Hoover, Ltd. (electric cleaners); Brittain Bros., Ltd. (radiators); H. Taylor & Co., Ltd. (electrical appliances, lamps, cleaners, &c.); the British Vacuum Cleaner and Engineering Co., Ltd. ("Goblin" vacuum cleaner); the Hurley Machine Co. ("Thor" electric washer and cleaner); and Electrolux, Ltd. (cleaners, &c.).

LIVERPOOL.—The General Electric Co., Ltd., recently co-operated with the Liverpool Corporation Electricity Department in a three-weeks' exhibition of large-scale cooking. The display of apparatus included examples of the company's baking ovens for bread and pastry, doughnut cookers, fish fryers, roasting ranges, urns, &c. A local firm of bakers carried out demonstrations of bread-baking, the preparation of confectionery, &c.

For Sale.

Bournemouth and Poole Electricity Supply Co., Ltd., has for disposal two Babcock & Wilcox water-tube boilers with superheaters and mechanical stokers, one Browett-Lindley vertical compound condensing engine direct coupled to a 200-kW. d.c. generator, one 12-h.p. vertical open type steam engine, one 8,000-gal. c.i. tank. The Salisbury Electric Light and Supply Co., Ltd., invites offers for one 95-h.p. Crossley gas engine with compressor, suction gas plant and accessories, 550-V dynamo, 500-V motor-generator, switchboard, &c. Grant Bros., of Croydon, have for disposal one 72-kW Metropolitan-Vickers generator, one shunt field rheostat, three double-pole circuit breakers, also a quantity of ammeters, voltmeters, and recording meters. (See our advertisement pages to-day.)

Bankruptcy Proceedings.

H. S. STEPHENS and S. WEILL, trading as Stephens & Weill, wholesale accessories merchants, 55, Great Eastern Street, E.C.—An application for an order of discharge was made on February 4th to Mr. Registrar Mellor at the London Bankruptcy Court on behalf of Weill, a member of the above firm which failed in August, 1927. Mr. Gaine, Official Receiver, reported that the provable debts amounted to £36,770; the assets had realised £1,224 and the trustee expected to pay a dividend of 4½d. in the £. The bankrupts began business in May, 1922, and the failure was attributed to losses by bad debts and by sale of goods slightly below cost price; also to excessive drawings. A loss on trading of £24,657 had arisen through the failure of a German firm to which the bankrupts had advanced £25,000. The debtor Stephens went out of the business in December, 1926, and Weill sent a circular to the creditors suggesting the formation of a company and that the creditors should accept shares for their claims. The suggestion was rejected and bankruptcy proceedings followed. The application was opposed by the Official Receiver on various grounds, including unjustifiable extravagance in living, fraud, and grave misconduct. His Honour upheld the Official Receiver's report and suspended the discharge for three years.

J. WESTNUTT (J. V. Westnutt), electrical engineer, 40, Alfred Street and High Street North, Dunstable.—Last day for proofs for dividend, February 22nd. Trustee, Mr. A. J. Rogers, Official Receiver, The Parade, Northampton.

C. H. PEARSON (B.O.A. Engineering Co. and Pearson & Co.), electrical, mechanical, sanitary engineer, &c., 51a, Mosley Street, and Stockton Street, Manchester, and 4, Manchester Road, Hyde.—Bankrupt discharged January 21st, 1929.

W. J. WARREN (Coleman & Warren), wholesale electrical supplier, 66, Victoria Street, S.W.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released January 22nd.

O. L. JONES (Jones & Evans), wireless dealer, River View, Hendre Road, Llangennech, Carmarthen.—Trustee, Mr. H. W. Thomas, Official Receiver, 4, Queen Street, Carmarthen, released January 16th.

A. P. & J. P. PACIFICO and R. FEITELSON (Comton Wireless Manufacturing Co.), 26-28, Bartholomew Square, E.C.—Last day for proofs for dividend, February 26th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

K. JOLIVARD & Co., electrical engineers, 66, Victoria Street, S.W.—Receiving order made February 6th on a creditor's petition. First meeting, February 18th; public examination, March 15th; both at Carey Street, W.C.

H. H. D. RADCLIFFE and F. HADDLETON (City Electric Services), electrical engineers, 51, Islington Row, Birmingham.—Receiving order made February 4th on debtors' own petition.

E. C. JENKINS, wireless dealer, 124, Cheltenham Road, Bristol.—First meeting, February 20th, at the Official Receiver's office, 26, Baldwin Street, Bristol. Public examination, February 22nd, at the Guildhall, Bristol.

W. T. JACOB, wireless engineer, 14, Meyrick Street, Pembroke Dock.—First meeting, February 15th, at the Official Receiver's office, 4, Queen Street, Carmarthen; public examination, February 18th, at the Shirehall, Haverfordwest.

Company Liquidations.

TRUPHONIC, LTD.—Winding up voluntarily. Liquidator, Mr. J. W. Attworthy, 121 and 123, Rosebery Avenue, E.C. A meeting of creditors was called for February 14th.

ATTAIX, LTD.—Winding up voluntarily. Liquidator, Mr. K. M. Scott, 32, Finsbury Square, E.C. Meeting of creditors, February 19th, at the Institute of Chartered Accountants, Moorgate Place, E.C.

PYE (RADIO), LTD.—Winding up voluntarily. Liquidator, Mr. W. J. Lovell, 199, Piccadilly, W.

BERRY'S ELECTRIC, LTD.—A meeting of members is called for March 12th at 85 and 86, Newman Street, W., to hear an account of the winding up from the liquidator, Mr. C. F. Saffery.

Private Arrangements.

R. E. A. EAVES and H. D. CAMERON, trading as the Empress Radio & Electrical Co., Stonehouse, Plymouth, and as the Westminster Radio Co., at Plymouth, Bridgwater, Taunton, and Newquay.—A meeting of creditors was held on February 5th at the Great Western Hotel, Paddington, when the debtors' accountant, Mr. White, stated that the liabilities amounted to £4,966, of which £2,424 was due to the trade, while there were partly secured creditors for £1,392, who held security valued at £1,200, leaving £192 to rank as unsecured. The net assets amounted to £1,300, leaving a deficiency of £3,666. The debtors had consulted relatives with regard to

their position, and if it were the wish of the unsecured creditors, sufficient cash would be forthcoming to pay the preferential claims in full, the costs of the deed of assignment, and the unsecured creditors 6s. in the £. The business was started in July, 1922, with a capital of £50 and tools. For the year to March 10th, 1927, the sales were £14,227, and there was a net profit of £236. The next year the sales were £18,065, and there was a profit of £28. In April, 1928, the firm suffered a serious loss through fire as they were under insured. Soon after that date the debtors opened branch shops. It was decided to accept the debtors' offer of 6s. in the £, and to confirm the deed of assignment already executed.

Social Events.

On January 30th the Beckenham Electricity Department held a departmental dinner, at which the chair was taken by Mr. F. Healey, deputy chairman of the Electricity Committee. Mr. Healey, in proposing the toast of "The King," said he had sent a telegram to His Majesty, hoping for his rapid recovery, and a reply had been received. Mr. Healey, in proposing the toast of "The Undertaking," referred to the absence of the chairman of the Committee, Mr. Jeff, through illness. Mr. J. E. Tapper (engineer and manager) responded to the toast, following which Mr. J. P. Wooller (commercial assistant) proposed the toast of "The Chief." After further toasts an excellent musical programme was provided by members of the staff, and "The Arcadians" dance band.

About 120 members of the staff and their friends assembled at the Moorgate Station Restaurant for the annual dinner of the Wholesale Fittings Co., Ltd., on February 2nd. Mr. John Alton, managing director, presided. Speeches were also made by Mr. S. Rose, director, Mr. E. Francis and Mr. John. After dinner there was a concert.

The annual staff dinner of Messrs. Abell & Smith's Electrical Co., Ltd., was held at Worcester recently. Mr. C. E. Abell presided, and other directors and guests (including Mr. J. H. Legge, S.W. & S. Power Co., and Mr. C. M. Shaw, city electrical engineer) were present. A musical programme followed the toasts.

On February 7th, the twenty-first "birthday" of F. and A. Parkinson, Ltd., Guiseley, was celebrated by a party at Horsforth, Leeds, attended by 450 members of the staff. This business, which recently amalgamated with Crompton & Co., Ltd., was founded by Mr. Frank Parkinson in 1908. The party was preceded by a complimentary dinner at the Queen's Hotel, Leeds, to the employés with over 10 years' service. The chair was taken by Mr. Frank Parkinson, supported by the Lord Mayor of Leeds (Alderman D. B. Foster), the Lady Mayoress, and Mr. Albert Parkinson. At the conclusion of the dinner the company proceeded to the party. Immediately preceding supper, members of the works Dramatic Society presented a play entitled "A Pantomime Rehearsal." Later, Mr. Frank Parkinson presented to Miss N. Senior (office staff) a gold wristlet watch and shares to the value of £50 in Crompton-Parkinson, Ltd.; to Mr. J. Ackroyd, works foreman, a gold cigarette case and shares to the value of £50; and to Mr. F. Dixon (works staff) a gold watch.

The Mayor of Leyton, on February 5th, entertained the members of the Corporation Electricity Committee to supper in celebration of the undertaking having enrolled its ten-thousandth customer.

Heads of departments of the Ribble power station, Preston, had a private dinner on February 7th. The guests included Councillor T. G. Lumb, J.P. (chairman of Blackpool Electricity Department), Councillor G. Whittaker, J.P. (vice-chairman), and Mr. C. Furness (manager).

Great Britain's Radio Exports.

The *Wireless World* states that the exports of radio apparatus from this country during November last had a value of £84,049 (including valves £9,960). The principal buyer was the Netherlands, whose share was valued at £11,241 (valves £60). The next in order were Australia, £10,111 (valves (£2,285); France, £7,301 (valves £174); Irish Free State, £6,042 (valves £929); India and Burma, £3,349 (valves £241); Rumania, £3,175 (valves £373); Germany, £3,167 (valves £82); and Italy, £3,126 (valves £16).

An Electrical Band Broadcast.

On Saturday last the Revo Electric Works Prize Band, under Mr. W. Taylor, rendered a programme of music which was broadcast from 5GB (Daventry experimental station). Another electrical company's band—Callender's—is already familiar to listeners.

A Useful Tool.

Messrs. R. E. COLLINGWOOD & SON, LTD., March Street Works, Rochdale, have sent us a sample of a little tool (the "Nipsit") which should be very useful to electricians. It is a reversible screw-driver, one end of which is of the normal pattern, the other having a spring tongue which inserted in the slot of a screw holds it tightly to give the thread a start. The blade, although easily removed, is firmly held by the ferrule in the handle.

Polish Foreign Electrical Trade.

The imports of "apparatus, conductors, and other electro-technical materials" into Poland during November last were valued at 12,193,000 zloty (£280,000), and exports of the same class at 61,000 zloty (£1,400).

Showroom Problems.

Mr. W. Millner's paper upon "Organising for Better Selling in Electrical Showrooms" (ELEC. REV., October 26th, 1928, p. 709) was discussed at an E.D.A. (North-Western Area) Conference held in Manchester, on February 6th, Mr. J. Thomas presiding.

Mr. L. ROMERO (Salford) questioned the wisdom of compelling consumers to journey to the showroom in order to pay accounts. In cities like Manchester and Salford the distance might be great. As a supply engineer he was chiefly interested in showrooms from the point of view of their influence upon the sale of energy, and in his opinion cooking, room heating and water heating were most important fields of extension.

Mr. RAYNER (Manchester) also disagreed with the idea of consumers being required to pay accounts at the showroom, and said it could not be expected that they would walk four or five miles for that purpose.

Mr. SHAW (Stockport), speaking as a contractor, remarked that people fancied many things which they saw in the showroom but could not afford to purchase them at the present figures. It was important that showroom assistants, when selling radiators, should inquire whether the place where they were to be installed was properly wired for the purpose.

Mr. ARNETT (Bolton) said that cost was the greatest difficulty in selling appliances. He hoped that manufacturers would do something to reduce prices. In Bolton the showroom had been very successful and the load had been increased; they were now endeavouring to improve the domestic demand, but it was difficult to do so under existing conditions.

The CHAIRMAN pointed out that in London the unemployment figures were less than 5 per cent.; in Lancashire they approached 20 per cent.; there was still a feeling that electrical fittings and appliances were luxuries.

Mr. CURLEY thought contractors did not make sufficient use of the showrooms provided by the supply authorities. It would be to their advantage to bring customers to see displays.

Mr. LOCKETT (Stoke) said that his department had a working arrangement with the contractors by which the trade discount was split. For general development it was a good scheme to appoint lecturers to visit secondary schools and impress upon the young people the great advantages of electricity over other means of heating and lighting. Classes from these schools could be taken to showrooms when demonstrations were being given.

Miss COLES asked what was Mr. Millner's experience of the effect upon contractors when supply authorities adopted the hire-purchase system.

Mr. SOUTHWOOD (Liverpool) said that in Liverpool the discount was given to the contractor whether the sale was made through him or through the showroom.

Mr. BARLOW said the electrical contractor was the unpaid canvasser for the supply authority but did not get much support from it. Something ought to be done in that respect. Did contractors have showrooms in Mr. Millner's district? If so, could they be made to pay despite the competition by suppliers?

Mr. TOMMINS (Manchester) suggested that contractors themselves were to blame for the opening of showrooms by the supply authorities. Their laxity had resulted in the ironmongers and large stores reaping a harvest which should have gone to the contractors.

Mr. WRIGLEY said that appliances were now cheaper and better than they were a few years ago. Salesmen handling household appliances should show confidence in the articles they effered.

Mr. RAYNER said that contractors should get together and arrange combined displays.

The CHAIRMAN said that the showroom cost was part of the selling cost. The question of stock was important. Appliances that went out of fashion or deteriorated very quickly were a serious charge.

Mr. MILLNER said that he did not suggest that it should be compulsory to pay accounts at the showroom. When customers were buying appliances the assistants might talk about the wiring installation and show the different types. If consumers could get appliances on easy terms progress would be rapid. His company's scheme was limited to articles costing £3 or more. If contractors could not run elaborate showrooms they could make reasonable window displays and have space for demonstrations.

Large American Acquisition.

It is announced that the Associated Gas and Electric Company, a holding concern, has contracted to acquire control of the General Gas and Electric Corporation, another holding company, controlling public utility services in Pennsylvania, New Jersey, New York, South Carolina, and Florida. The resulting corporation will have gross earnings totalling some $70,000,000 (£14,000,000) a year.—*Reuter* (New York).

Fire.

On the night of February 6th a serious fire caused considerable damage to the premises and stock of Philips Lamps, Ltd., 27, Womanby Street, Cardiff. Arrangements have been made whereby business will not be interrupted.

Book Notices.

"Southampton Docks: Handbook of Rates, Charges and General Information." (Pp. xxxviii+168). Southampton: The Southern Railway Co.—This new edition of the handbook is, like its predecessors, full of useful and interesting information and should be of great service to shippers and merchants.

"The Blue Book Electrical Trades Directory and Hand Book."—The 1929 edition of the Blue Book is the forty-seventh consecutive yearly issue. The whole work has been thoroughly revised and brought up to date. The geographical section for Great Britain, Scotland, and Wales has been considerably amplified, and Northern Ireland is now included. A new feature is a complete list of electrical contractors; in this list the names of those who are enrolled on the National Register, members of the Electrical Contractors' Associations of England and Scotland are distinctly marked. The increase in the number of the guide cards facilitates reference to any section, and in other respects the high standard of production has been fully maintained.

"Physics in Industry."—Reprints of four lectures recently delivered before the Institute of Physics, relative to the food industry, glass industry, photography, and astronomy.

"Practical Primary Cells," by A. Mortimer Codd. Pp. viii+127; figs. 53. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Technologisches Handbuch der Elektrotechnik und der Elektrochemie eine Encyklopädie der Elektrotechnik," by A. Schlomann. Pp. xviii+897; illustrated. Berlin: Technische Wörterbücher-vertag G.m.b.H. Price Rm. 80.

"Electricity applied to Mining," by H. Cotton. Pp. xi+625; figs. 359. London: Sir Isaac Pitman & Sons, Ltd. Price 35s. net.

"Yarrow Boilers." Scotstoun: Yarrow & Co., Ltd.—A brief description, with two drawings, of a 600-lb. per sq. in. steam boiler installation.

"Pulverised Fuel Plant." Pp. 12; figs. 12. Manchester: Simon-Carves, Ltd.—Reprint of an article descriptive of the application of powered-coal plant to collieries.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during December last were valued at £69,752, bringing up the total for the whole of the past year to £552,999, as compared with £385,898 in 1927.

New Italian Companies.

Among the companies recently formed in Italy are the Società Industrie Elettriche Ponzini, Milan, capital 150,000 lire; and La Società Idroelettrica Venaschese, Venasca (Cuneo), capital, 1,200,000 lire.

Salford and Dutch Cable.

Salford City Council by 29 votes to 19 on February 6th confirmed the Electricity Committee's decision to accept the tender of a Dutch firm amounting to £9,358 for electric cables. A councillor said that the difference of price in tenders from British and foreign firms that were suitable was £2,080. One British firm said that it was impossible to reduce the tender price, but the firm was selling cable in Holland at a cheaper rate than the Dutch company.—*Financial Times.*

Unemployment.

During the week ended January 28th there was a fall of 31,520 in the number of registered unemployed. The total at that date was 1,394,100, as compared with 1,425,620 on January 21st, and 1,168,941 on January 30th, 1928.

The G.E.C. in South Africa.

Electric lighting has just been installed throughout the Divisional Council Offices in Dorp Street, Cape Town, and a large number of special fittings designed and supplied by the Cape Town branch of the British General Electric Co., Ltd., are used for illuminating the various sections. The Post Office is illuminated by means of 10-in. "Verilux" bowl pendants, finished in real bronze colour and equipped with "Superlux" glassware. "Britalux" lighting units are used in the ground floor offices. A number of specially designed bronze colour fittings are installed in the Council Chamber, while the even lighting of the Committee Room is contrived by a number of superb electroliers. The whole of the fittings were designed to be in keeping with the dignified architecture of the building. Several other Cape Town premises have been similarly equipped by the British G.E.C.

New Catalogues and Lists.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—A coloured poster (20 in. by 30 in.), advertising the company's l.t. accumulators for radio work. The centrepiece is an illustration of the "DTG" 2-V type. Prices are given.

MESSRS. ALLEN WEST & CO., LTD., Brighton.—A folder illustrating examples of the company's liquid rotor starters and regulators.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Spare Part List No. 6,845 (d.c. circuit breakers, tramcar pattern); and Descriptive List No. 5,270-A (hand-operated three-phase auto-transformer starters).

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet B.C. 4911, illustrating and describing the "Gecophone Portable Screen-Grid Four" receiving set. Priced.

DIXONIA, LTD., 4, Portsmouth Street, Kingsway, W.C.2.—A series of illustrated and priced leaflets giving particulars of electrical fittings and wires for saloon coaches.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., U.S.A.—A collection of pamphlets dealing with many of the company's varied products—motors, switchgear, &c.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—List No. 118, containing illustrated details and prices of the company's ironclad switch- and fuse-gear.

MESSRS. VERITY'S, LTD., Aston, Birmingham.—A distinctive and attractive folder advertising "Orbit" oscillating electric fans.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, S.W.1.—A small representation of a telephone kiosk drawing attention to the "Venner" time switch which is used to control the lighting.

THE LEA RECORDER CO., LTD., 28, Deansgate, Manchester.—Booklet C.M.6 dealing with the use of the Lea coal meter in connection with mechanical stokers. Photographs of actual installations are reproduced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—List No. 600. In spite of its modest description this is a very comprehensive electrical buyers' guide. It comprises 616 pages of illustrated details and prices of wiring materials and accessories, motors and dynamos, switch- and fuse-gear, instruments, lighting fittings for special purposes, lamps, domestic appliances, &c. A complete and convenient index is provided. It is noteworthy that 82 per cent. of the goods listed are British.

KORTING & MATHIESEN ELECTRICAL, LTD., 711 and 715, Fulham Road, S.W.6.—List No. L. 91028, dealing with "Kandem" industrial lanterns for general exterior and interior lighting. Illustrated and priced. Also the "Kandem Quarterly Review" for January.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—February stock list of motors, generators, &c.

MESSRS. WOLF & MORGAN, LTD., 66, Victoria Street, S.W.1.—An illustrated folder describing the "Wagner" split-phase motor.

American Electrical Engineers in Russia.

It is reported that early this month representatives of the American General Electric Company, Messrs. Tron and Prax, arrived in Moscow. They came from New York to enter into negotiations with the General Electrical Commission with regard to the carrying out of the agreement recently entered into with this company concerning the purchase of electrical plant on credit. At the same time representatives of the Robinson company, which is said to be the largest American constructional firm in electrical work, have arrived to negotiate respecting participation in Russian electrical work. The Americans are now about to pay visits to Soviet undertakings in existence or progress as represented by the Dnieper station, the Schatur station, &c., for the purpose of making themselves acquainted with Russian work.

Recent Contracts.

During the past month Messrs. JOHNSON & PHILLIPS, LTD., have booked the following orders for transformers:—

Two 5,000-kVA, 3-phase, for the Woolwich Corporation.
Four 2,500-kVA, 3-phase, for the East Anglian Electric Supply Co., Ltd.
Four 2,500-kVA, 3-phase, for the Ipswich Corporation.
Two 1,800-kVA, single-phase, for the New South Wales Government Railways.

The gymnasium and swimming baths at the Y.M.C.A. headquarters, Tottenham Court Road, W., have recently been illuminated with 500-W "Osram" gasfilled lamps housed in "Geco" dispersive reflectors with galvanised steel guards. The electrical contractors were Messrs. T. W. COFFIN & SONS, LTD., 17, Arthur Street, W.C.2.

An Unofficial Directory.

The attention of the Department of Overseas Trade has been drawn to the proposed issue by a private firm of a "Consular Directory." This directory is neither an official nor a semi-official publication, and is in no sense being issued with the approval of the Government. The Department of Overseas Trade issues for the use of commercial diplomatic officers, trade commissioners, and consular officers an official directory of British manufacturers known as the Trade Index. No charge is made for the entry of particulars as to the manufactures of any British firm in this index. British manufacturing firms whose names are not entered in this should make application to the Department for an entry form.

Correction.

We regret that a printer's error destroyed the sense of the fourth line of the advertisement of the PRODUCTS CORPORATION, LTD., in our last issue (p. ix). The line in question should have read:—"in eight alloys from 20% tin/80% lead."

Trade Announcements.

Messrs. JAMES MCNEILL & CO. (SHEFFIELD), LTD., Napier Street, Sheffield, inform us that in order to cope with the increasing demand for their "Eclipse" hack-saw blades and frames they have constructed a new machine shop at their Sheffield premises.

DIXONIA, LTD., 4, Portsmouth Street, Kingsway, W.C.2, announces that it has purchased the plant and goodwill (with the exception of the experimental engineering and tool-making departments) of Fluid Pressure Pumps, Ltd., Clifton Street, W.11.

Messrs. GRIFFIN, HARDING & BRYANT, LTD., electrical engineers, Swindon, have transferred their showroom from 66, Devizes Road, to larger premises at 1, Park Lane.

Messrs. VERITYS, LTD., have taken additional premises at 7, New Station Street, Leeds, to deal exclusively with plant and switchgear, in the charge of Mr. R. J. Millard. Mr. Hoyle and Mr. Richard have joined the Manchester staff, and Mr. H. S. Stoppard the Newcastle staff, to deal with the new range of "Maxlume" fittings and fires, for which additional premises have been acquired.

Mr. ALEXANDER MCKAY, Aberdeen, has removed to larger premises at 41, The Green.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, February 12th:—Electrolytic copper bars, £84 10s., £5 15s. inc.; ditto, ditto sheets, no change; ditto, ditto wire rods, £94 10s., £5 15s. inc.; ditto, ditto h.c. wire, 11⅛d., ⅛d. inc. silicium bronze wire, 1s. 0⅛d., ⅛d. inc.

Messrs. James & Shakespeare report, February 12th:—Copper bars (best selected), sheet and rod, £108, £4 inc.; English pig lead, £24 15s., 20s. inc.

Messrs. Edward Till & Co. report, February 12th: No change in the price of India-rubber, Para fine.

Reporting on February 9th, Messrs. James Forster and Co. stated that the lead market maintained a firm tone throughout the week and prices registered a daily advance. Conditions in America have also remained firm, and prices have advanced. Last week considerable buying was done by the cable trade as a result of orders placed by the Post Office. This week an exceedingly good demand is reported for manufactured lead, and manufacturers have been busy covering their requirements in the market. Arrivals meanwhile have not been over plentiful; there is a shortage of prompt lead, while the prospect for next month is for small arrivals.

Lighting and Power Notes.

Barnstaple.—NEW DIESEL SET.—The Town Council has received sanction to a loan of £6,222 in connection with the installation of a 300-kW Diesel set at the electricity works.

Bebington and Bromborough.—STREET LIGHTING.—Electricity for street lighting has been adopted by the Urban District Council. The supply will be provided by the Birkenhead Corporation and Lever Bros. It is intended to erect 108 standards and the annual cost of operating the scheme will be £1,692.

Birkenhead.—LOANS.—The Corporation Electricity Committee is applying for sanction to borrow £5,000 for the equipment of sub-stations on consumers' premises and £1,360 in connection with the extension of h.p. mains and the installation of an additional switchgear cubicle at the Singleton Avenue sub-station. Sanction has been received to the borrowing of £16,468 for the provision of a 33,000-V transmission line between Birkenhead and Wallasey power stations.

OVERHEAD LINES.—The consent of the Ministry of Transport has been received to the placing of overhead lines in the parish of Thornton Hough for the transmission of electrical energy at pressures of 11,000 V and 240 V for the purposes of the Wirral and Neston Electricity Special Order, 1925.

Blackpool.—LOAN.—The Corporation is applying for sanction to a loan of £8,000 for the purchase of cookers, wash boilers, &c., to be let out on hire.

Bradford. — SWITCHGEAR. — The Corporation Electricity Committee has approved a scheme submitted by the city electrical engineer (Mr. T. Roles) for reorganisation of the e.h.p. switchgear at Valley Road generating station, at a total estimated cost of £75,460. The town clerk has been authorised to apply for sanction to a loan, and the city electrical engineer authorised to invite tenders.

STREET LIGHTING.—The conversion of street lighting from gas to electricity (the electricity to be supplied by the Corporation) in the areas within the Bradford boundary at present lighted by the Pudsey Gas Co. and the Drighlington and Gildersome Gas Co., is expected to cost £10,415. The annual charge to the Finance Committee for maintenance and for electricity supplied by the Electricity Department will be £2,672 per annum. The scheme involves the use of 622 electric lamp standards in place of the existing 500 gas lamps, and includes time-switch control.

Bristol.—NEW SWITCHGEAR.—The Corporation Electricity Committee reports that, in consequence of the growth of the undertaking, and in order to comply with Home Office requirements, it is necessary to replace e.h.p. switchgear at Feeder Road by larger and more up-to-date switchgear. The cost of the new work will be approximately £26,090, which includes £7,000 for building work.

Canada.—QUEENSTON PLANT EXTENSION.—The Hydro-Electric Power Commission of Ontario has decided to install the tenth and final unit of 65,000 h.p. at the Queenston plant on the Niagara River. The new generator will cost approximately $500,000, and the total expenditure on the completion of the power house will be $5,000,000. This addition will give the Commission a normal operating capacity in its three plants on the Niagara River aggregating over 900,000 h.p. The additional requirements of the Commission in the Niagara district are being met by the introduction of purchased power, principally under the 260,000 h.p. contract with the Gatineau Power Company. Rapid expansion in the power requirements of the 300 municipalities in southern Ontario served by the Niagara distribution system is expected to call very soon for the maximum of power available from existing sources.

RURAL TRANSMISSION.—During the fiscal year ended October 31st last, the Ontario Provincial Legislature approved the extension of rural hydro-electric power lines in that Province by 925 miles at an approximate cost of $2,250,000, of which the Provincial Government pays one-half. Rural lines operated by the Ontario Hydro-Electric Power Commission now total 4,190 miles, and have involved a total expenditure of about $8,600,000.

Continental.—ITALY.—The new San Bernardo hydro-electric station of the Società Elettrica Interregionale Cisalpina was recently put in operation. The plant, which is located in the Splugen valley, near Chiavenna, 3,280 ft. above sea level, utilises the water power of Lake Truzzo. So far, two 12,000-kW turbo-generators have been installed, but space has been provided for a third set of similar capacity at a later date.

FRANCE. — A short-circuit on one of the main cables at about 9 a.m. on February 6th at the Saint-Ouen power station resulted in the failure of the electricity supply in 14 of the 20 arrondissements of Paris which lasted for the greater part of the day. Fire was seen coming from a manhole, and the fire brigade discovered that the seat of the fire was an underground gallery containing a number of 12,000-V cables. It was after midday before it was extinguished. Nearly all the tramcars ceased running, and the "Metro," which possesses an emergency plant, maintained a reduced service.

A fire which broke out at the power station in the Rue Honoré Sauvan, at 6.30 p.m. on February 7th, caused a failure in the electricity supply in the quarter of the town where the Casino, largest hotels and shops are situated. The supply was not restored for the rest of the evening.

What is stated to be the first underground cable for the transmission of d.c. at 300,000 V, has recently been completed by the Société Grammont for the Société Générale de Force et Lumière.

GERMANY.—The municipal authorities of Stuttgart are considering the question of erecting a new steam-operated power station which would have a capacity of 90,000 kW.

HUNGARY.—The new power station which is being erected at a lignite colliery at Banyhida under the auspices of the Hungarian Government will have a capacity of 90,000 h.p. and in addition to supplying electricity for lighting and power purposes in the Budapest district will also provide electricity for the railway between that city and Hegyeshalom.

Eastbourne.—SUB-STATION EXTENSIONS.—The Corporation Electricity Committee has approved the erection of four new sub-stations, the installation of eight transformers with a total capacity of 2,000 kW at various sub-stations, and a number of h.p. cable extensions, at a total estimated cost of £11,350. Application is to be made for sanction to a loan for these purposes.

Glasgow.—STREET LIGHTING.—In his report on the working of the Corporation Lighting Department for the year ended May 31st last, the inspector of lighting (Mr. S. B. Langlands) states that the net ordinary expenditure on the lighting of streets, courts, &c., was £211,763, and on the lighting of common stairs, £146,588. The length of additional streets lit by electricity was 32 miles, bringing the total mileage up to 160, with a consequent increase in the number of lamps in use from 6,485 to 8,594.

MAINS EXTENSIONS.—The Corporation Electricity Committee has recommended that distributing mains be laid at a cost of £14,000.

Gloucester.—LOAN.—The Town Council has decided to apply for sanction to a loan of £90,345 to cover past and prospective expenditure. The prospective expenditure includes £10,000 for rotary convertors, £10,000 for mains and services, and £550 for public lamps.

Hastings.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to carry out mains extensions at a cost of £2,312.

LOAN.—Application is being made for sanction to a loan of £1,000 for transformers.

Knaresborough.—PRICE REDUCTION.—The Urban District Council has reduced the charge for electricity for lighting from 7d. to 5d. per kWh, and it is expected that when negotiations

now proceeding with Harrogate Corporation are completed the price will probably be reduced by a further 1d. per kWh.

Lancaster.—EXTENSION OF AREA.—The Electricity Committee has had under consideration the cost of extending the area of electricity supply to include the rural district of Lunesdale and parishes in the rural district of Lancaster. Negotiations are to be opened with the Rural District Councils, and if they have a satisfactory outcome, the Town Council will apply for a Special Order.

Laugharne (Carmarthen).—PROPOSED NEW STATION.—Application has been made to the Electricity Commissioners by Messrs. Tudor Williams Bros. for consent to the erection of a generating station in the town.

Liverpool.—COMMERCIAL COOKING TARIFF.—A special rate has been introduced for electricity for heavy and commercial cooking apparatus at ½d. per kWh, except between the hours of 4 p.m. and 6.30 p.m., from October 1st to March 31st inclusive. During these hours the lighting rate applicable to the districts in which the premises supplied are situated will be charged.

Lochaber.—BEN NEVIS TUNNEL.—Mrs. Halcrow, wife of the consulting engineer, fired off the last shot on February 9th, which opened up the 15-mile tunnel through the Ben Nevis range in connection with the Lochaber water-power scheme. Although boring operations have now been completed, the tunnel has for half its length still to be lined with concrete. The undertaking is being carried out for the British Aluminium Co., and there will be a total development of 120,000 h.p.

Longbenton (Northumberland).—INQUIRY INTO CHARGES.—At a meeting of the Urban District Council on February 7th it was decided to apply to the Electricity Commissioners for an inquiry into the charges for electricity.

Manchester.—REDUCTION OF TARIFF.—The *Daily Dispatch* reports that electricity on easier terms is now being granted by the Corporation to its tenants on the municipal housing estates. The deposit for installation has been reduced from £1 to 10s. The reduction has been made retrospective for the benefit of old consumers, who, provided their accounts are not in arrear, can obtain a refund of 10s., plus accumulated interest, on application at the Town Hall.

New Zealand.—WELLINGTON.—The accounts of the city electricity undertaking (general manager, Mr. M. Cable) for the year ended March 31st last show a total income of £340,018, and working expenses of £144,352, leaving a gross profit of £195,666. The figures for the preceding year were: Income, £286,821; working expenses, £126,500; gross profit, £160,321. Interest, sinking, renewal and reserve funds, and appropriations absorbed £144,049, and there was a net surplus of £51,617, as compared with £23,941 in 1926-27. The electrical energy purchased in bulk from Mangahao decreased from 32,458,396 to 26,665,630 kWh, and the electricity generated from 6,505,528 to 19,648,139 kWh. During part of the year the Public Works Department was short of power and the City Council supplied 8,529,865 kWh through the Khandallah sub-station. The sales of electricity increased from 27,161,009 to 30,212,973 kWh, and the maximum demand from 11,400 to 12,910 kW. The Council in changing over the system of supply from 100 V, 80 cycles, to 400/230 V, 50 cycles, and this work is nearly completed.

Scotland.—WATER-POWER OPPOSITION.—A number of petitions have been lodged against the Grampian Hydro-Electric Scheme, including those of 24 town and county councils, two railway companies, the Forestry Commissioners, and several landowners. The West Highland scheme has also aroused considerable opposition. The objections to the schemes are based principally on loss of rating, destruction of fishing, and damage to shooting rights and scenery, the disorganisation of forestry, and the additional burdens the schemes would impose on local authorities.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £7,000.

Southport.—LOAN.—The Corporation Electricity Committee has decided to apply for sanction to a loan of £1,900 for new h.p. and l.p. mains, kiosk, switchgear, and transformer, in order to provide an electricity supply to Scarisbrick.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by the Holderness Trust, Ltd., authorising it to supply electricity in the urban district of Hornsea, and part of the rural district of Skirlaugh.

The Minister of Transport has confirmed a Special Order, made by the Electricity Commissioners, authorising Blackburn Corporation to supply electricity in the township of Pleasington.

Stoke-on-Trent.—CHANGE-OVER.—The Corporation Electricity Committee has authorised the following change-over in supply to 50 cycles: From d.c. supply in the High Lane, Burslem, £2,300; Church Street, Longton, £1,200; and Porthill, Wolstanton, £2,300; and from 100-cycle supply in the central area of Hanley, £5,000.

Stretford.—LOAN.—The Urban District Council Electricity Committee has applied for sanction to borrow £20,000 for the provision of mains and services.

United States.—DOMESTIC ELECTRIFICATION.—Estimates prepared by the Statistical Department of the National Electric Light Association in the United States indicate that 842,000 homes and farms were wired for electricity during the first nine months of 1928. By the inclusion of farms in the total number of homes, two-thirds of all homes in the United States now have electricity; excluding farms, about 82 per cent. of all homes are wired. New Hampshire leads with 97 per cent. of all homes wired on September 30th last, followed by New Jersey with 95 per cent., Rhode Island with 93, Utah with 89, Connecticut with 88, and Illinois with 85.

NEW POWER STATION.—According to *Power*, a definite step toward the erection of one of the world's largest electric power stations has just been taken by the Public Service Electric and Gas Company, a subsidiary of the Public Service Corporation of New Jersey, with the purchase of about 125 acres of land on Arthur Kill, just north of Sewaren, N.J. The ultimate capacity of the new station will be 1,000,000 kW. Although preliminary surveys and subsoil studies are now being made, it will probably be several years before actual construction will begin. The new station is planned in view of the expected growth of the territory in which the company operates. Power from the proposed Sewaren station will not only feed the rapidly-growing industrial section of Central New Jersey, but the station will constitute one more power source, feeding into the Public Service Co.'s so-called "inner ring." This ring at present, through a series of transmission lines, receives power from major stations at Kearny, Essex, and Marion. It will also tie in with the interconnected systems of the Public Service, Philadelphia Electric and Pennsylvania Power and Light Companies. Thus the territory served by the three companies has available electrical energy from one of the largest power pools in the world.

HELL GATE TURBO-GENERATOR.—The 160,000-kW turbo-generator constructed by the Brown-Boveri Co. for the Hell Gate power station in New York has lately been completed and put in preliminary operation. The new set is notable in that it occupies no more floor area than was formerly occupied by a 30,000-kW set.

West Lothian.—SCHOOL LIGHTING.—The Education Authority has agreed to convert the lighting systems in a number of the schools under its supervision from gas to electricity.

Wrexham.—ASSISTED WIRING SCHEME.—The Town Council has adopted a scheme for installing electric light in houses on the hire-purchase system, with a maximum of five points, and a loan of £6,000 is to be applied for to meet the estimated cost of 400 installations during the first year. The wiring is to be carried out by electrical contractors to the Corporation's specifications, and the charge for electricity is to be 8d. per kWh through 1d. slot meters for the first 800 kWh, after which the ordinary lighting rate for slot meters generally will be charged. A net surplus of £280 per annum is anticipated.

York.—CHANGE-OVER.—The Corporation is applying for sanction to change over the system of electricity supply to all consumers who are at present taking a d.c. supply at 230 and 460 V to a.c. at 230 and 400 V, 3-phase, 50 cycles.

ALL-ELECTRIC HOUSES.—The city engineer has recommended the Corporation Housing Committee to erect all-electric houses on the Nursaws estate, where there is accommodation for about 174 houses.

Tramway and Railway Notes.

Australia.—SYDNEY.—Steady progress is being made with the electrification of the Sydney suburban railways and the construction of the city underground railway. According to the *Electrical Engineer of Australia and New Zealand*, the report of the Railway Commissioners for the year ended June 30th last states that the whole of the work in connection with the electrification of the Hornsby to Milson's Point line, including the construction and erection of a carriage shed at Hornsby, has been finished, and a full electric train service is now running. The electrification and provision of two additional roads from Illawarra Junction to Homebush have been completed. Work of electrification is in progress on the Homebush to Parramatta section, and several new sub-stations have been erected or are under construction. The section of the city railway from Central station to St. James' has been in satisfactory operation for some time. Work is being pushed ahead on the construction of other sections. Excavations and tunnelling are in progress at Wynyard and the Town Hall stations and in the section adjacent to these. Tunnelling is also in progress between Wynyard station and Circular Quay.

Barking.—ABANDONMENT OF TRAMWAY.—*The Times* reports that the tramcars belonging to the Barking Urban District Council, which run between Barking and Beckton, will cease to operate in a few days. These tramcars are the only ones now owned by the Council, the other tramway section which runs through the town having been leased to the East Ham and Ilford Town Councils. The tramways to Beckton have always been a burden on the rates, but as they carried the men living at Barking to their work at Beckton Gas Works, the Council have deemed it advisable to keep them running, although the loss has been about £6,000 a year. Some two or

three years ago the London General Omnibus Co. was approached with a view to running a service of omnibuses to Beckton. The company stated that it was prepared to run the omnibuses if a suitable road were constructed. This has now been done at a cost of about £26,000, and omnibuses will take the place of the tramcars.

Chatham.—ABANDONMENT OF TRAMWAY.—The Chatham and District Light Railways Co., Ltd., is seeking powers to abandon the electric tramway in the district, and the City Council was to hold a special meeting on February 12th to consider the question of opposing the application.

Chile.—RAILWAY ELECTRIFICATION.—According to the *Financial News*, at the annual meeting of the Chilian Transandine Railway Co., Ltd., held on February 5th in London, it was stated that the year's operations had resulted in a deficiency of £8,004. This had been occasioned by a decrease in the number of passengers carried, by a serious decrease in the cattle and public goods traffic, and by extra expenditure in connection with repairs and renewals of the track, which were necessitated by the installation and inauguration of electric traction, which took place in October, 1927. The electric service, however, from a technical point of view, had been a complete success.

Continental.—SWEDEN.—The signalling and switch systems at the Stockholm and Gothenburg railway stations are to be electrified and centralised. The reconstruction work will be completed before the end of April, 1930.—*Reuter's Trade Service* (Stockholm).

ITALY.—The Florence correspondent of the *Daily Mail* reports that good progress has been made with the construction of a tunnel, over 11 miles in length, through the Apennines in connection with the new railway between Bologna and Florence. The new route is over 60 miles in length, and it will be covered by electric trains in about 1¼ hours. When the line between Rome and Florence has been completed and the Florence-Bologna line is open, there will be a direct and rapid train service through the whole of Central Italy.

SPAIN.—Tenders are expected to be invited shortly for the electrification of about 2,000 km. of railway in Spain. The saving in coal resulting from the change is estimated at 600,000 tons a year. It is thought likely that the contract for the lines to be electrified will be awarded as a whole, so that the material will be all of the same type, which will mean a saving of money and simplification in orders. It would not be surprising if this principle were also applied to material for the railways under construction that are to be worked directly by the State, or leased in groups.—*Reuter's Trade Service* (Madrid).

Dearne Valley.—TRANSPORT AGREEMENT.—The Dearne district Light Railway Committee and the Yorkshire Traction Co. have entered into an arrangement under which the municipally-owned tramcars and the privately-owned 'buses are to be operated under one control in the Dearne Valley district of South Yorkshire. The Committee is responsible for the tramway system constructed four years ago at a cost of £300,000 by the Wombwell, Wath-on-Dearne, Bolton-on-Dearne, and Thurnscoe Urban District Councils.

Increases of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising certain fare charges by the following tramway and light railway authorities:—The Corporations of Colne, Burton-on-Trent, Luton, York, the Corporation of Gloucester and the County Council of Gloucestershire, the Urban District Councils of Bexley and Dartford, the Bath Electric Tramways, Ltd., the Scarborough Tramways Co., the Swansea Improvements and Tramways Co., the South Lancashire Tramways Co., the Norwich Electric Tramways Co., the London United Tramways, Ltd., and the Llandudno and Colwyn Bay Electric Railway, Ltd. These Orders will remain in force until December 31st, 1931.

Jarrow.—ABANDONMENT OF TRAMWAY.—The Jarrow and District Electric Traction Co., Ltd., is seeking power to abandon its tramway and substitute motor-'buses.

London.—S.M.E. TRAMWAY CARS.—The South Metropolitan Electric Tramway Company has announced its intention to re-model its tramcars so as to provide greater comfort for passengers. Work is now in hand, and it is hoped to introduce them in service rapidly on the Sutton-Croydon route; the remodelling process is so complete as to alter entirely the appearance of the vehicle. The usual ornamental fittings on the exterior, including the waist rail, have been removed, and the cars now present a "streamlined" appearance; dashboards have been broadened and painted red with black streamline bands, whilst the grille-work of the top deck has been replaced by steel sheeting in order to give a better appearance and afford fuller protection for passengers in inclement weather. Considerable alterations also have been made to the interior: the wooden longitudinal seats have been replaced by comfortable moquette-covered cross seats; the roof has been enamelled white; gasfilled electric lamps have replaced those of older type; and another improvement is the introduction of hardwood flooring. On the top deck the seats have been rendered more comfortable by giving them a "kneed" back; they have also been placed further apart. Advertisements and traffic notices have been restricted to a few positions only, instead of being dotted promiscuously all over the car as heretofore. Several cars are already in service on the Sutton to Croydon route and others will be introduced upon the same route as they are completed.

Telegraph and Telephone Notes.

Chile.—PHOTO-TELEGRAPHY.—A company has recently been formed in Santiago, with a capital of £75,000, to introduce wireless picture telegraphy into Chile.

France.—TELEPHONE TARIFF.—Telephone rates are to be raised in consequence of the deficit shown in the past. Government officials are of the opinion that the telephone system should be made self-supporting as in Britain and the United States.

International Telephony.—SWEDEN-ARGENTINA.—Telephone communication was established on February 9th between Stockholm and Buenos Aires by means of a wire circuit to Berlin, thence by wireless to the Villa Elisa station, near Buenos Aires.—*Reuter* (Stockholm).

Post Office Cables.—YEAR'S WORK.—Post Office statistics show that last year ducts and cables containing approximately 600,000 miles of telegraph and telephone wire were laid underground at a cost of £4,280,000. About 40,000 miles of this represented diversion of overhead wires. Damage to telegraph and telephone lines by gales during the year cost the Department £400,000, which figure was above the average, owing to the exceptionally severe weather. During the last four years £44,000,000 has been spent on capital account for the development of the telephone service, with the result that five-sixths of the telephone wires of the country are now laid underground.

The Telegraph Service.—The Association of British Chambers of Commerce recently addressed an inquiry to the Postmaster-General relative to the action which had been taken by the Post Office upon the recommendations contained in the report of Sir Hardman Lever's Committee on the inland telegraph service. In his reply, the Postmaster-General states, according to the *Daily Telegraph*, that five recommendations are still under consideration. Arrangements have been made which will facilitate more frequent adjustments of staff to traffic in the larger telegraph offices. The telegraph supervising force in London and the larger provincial post offices has been reduced in the last two years by about 160 posts. The replacement of Morse by teleprinter apparatus is being carried out as rapidly as possible, regard being had to the rate at which teleprinter apparatus can be manufactured and telegraph operators can be trained to work it. The question of concentration of traffic is being pursued, and circuits unnecessary for traffic purposes are being suspended.

United States.—TELEPHONE SERVICE.—According to *Telephony*, the organ of the industry in the United States, 860,000 telephones were added to the American systems during 1928, making the total in service 19,380,000. The United States has now more than five times as many telephones as the whole of the British Empire, and more than eleven times as many as Great Britain, although America's population is only two and a half times as great. The expenditure last year on extension and improvement of the American service totalled £100,000,000, of which £90,000,000 was spent by the Bell Company, and £10,000,000 by the American Telegraph and Telephone Co. Expenditure authorised on the British telephone system for the year ended March last was only £12,000,000. Manned by 400,000 men and women, the United States systems handled 76,000,000 completed calls daily, making a year's total of 28,000 millions, of which more than 1,100 millions were toll or distance calls.

Radio Notes.

Canada.—LICENCES.—More than a quarter of a million Canadians using receiving sets had paid the Government tax of one dollar up to the end of November, 1928, an increase of 17,000 compared with the end of November, 1927, reports the High Commissioner for Canada in London. According to the *Board of Trade Journal*, the returns indicate that there are 226,240 private receiving licences, although it is believed that more than 100,000 sets exist on which no licence has been issued. The revenue from the issue of licences is devoted by the Department of Marine and Fisheries to the improvement of radio services, about a score of radio interference investigation cars being in use.

SHORT-WAVE CONFERENCE.—Seeking agreement on the allotment and control of the 639 short wave-lengths used principally for ship-to-shore, aeroplane, and other non-commercial broadcasting, representatives of the Governments of the United States, Cuba, Newfoundland, and Canada opened a conference in Ottawa on January 21st. The chairman, Mr. Sykes, of the United States delegation, made it clear that there was no disposition on the part of his country to establish a monopoly of short wave-lengths, and that in spite of the fact that of all the 639 channels but 245 had been set aside by international agreement for amateurs, the Conference was undoubtedly free to discuss the disposition of all those channels. Drastic provi-

sions for the prevention of interference with non-commercial and service waves have been drafted: the recommendations are intended to apply only to the band between 15,000 and 6,000 kilocycles, and to stations capable of causing international interference. Their recommendations were later reported to the plenary conference which, it is expected, will approve of them.

According to *World-Radio*, the recommendations are as follows:—The Governments agree to adopt a frequency standard based on the unit of time, and to compare at least once every six months the actual radio-frequency measuring standards; all stations other than mobile and amateur stations to tune their transmitters within an accuracy of 0.025 per cent., or better, of their national frequency standard; and to maintain their frequency with an accuracy of 0.05 per cent., or better, at all times. Each Government agrees to adopt for the present separation of 0.2 per cent. between channels; for commercial telephony a band width of six kilocycles will be permitted; for the present, a 100-kilocycle band width will be considered standard for television; to use transmitters which are as free as practicable from all emissions (such as harmonics, decrement, spacing waves, frequency modulation, key clicks, type of keying, mush, &c.) not essential to the type of communication carried on, which would be detrimental to communication being carried on by stations in other countries.

Holland.—RADIO COUNCIL.—The Radio Council recently formed by the Dutch Government for the purpose of exercising general control over all wireless-telegraphy and telephony in the country has held its first meeting. The Minister of Waterstaat, under whose Department the Council will work, pointed out that as yet broadcasting in Holland was not in a satisfactory state, and many difficult problems would have to be solved by the Council.

Luxemburg.—LIMITED SERVICE.—The Grand Duchy now possesses a broadcasting station, Radio-Luxemburg, which can, it is reported, be heard throughout the whole State. At present the sole resources of the station are derived from the subscriptions of members of the Association of Friends of the T.S.F. for the development of broadcasting in the Duchy, says *World-Radio*; owing to the limited income, it is not possible to give daily transmissions.

Switzerland.—CANADIAN COMMISSION.—The Canadian Broadcasting Commission, which is now examining various broadcasting systems in Europe, visited Geneva on February 8th and had discussions with members of the Communication and Transit Section of the League of Nations and with the Secretary-General of the Union Internationale de Radiophonie.

United States.—"BEAM" BROADCASTING.—Station WTIC, situated on the top of Avon Mountain, near Hartford, Connecticut, is to experiment with directional broadcasting with a beam transmitter next June; it is proposed to transmit from eight to ten times greater power towards the west than towards the east (50 kW directed one way and only 5 kW the other), so that waste of power over the Atlantic Ocean will be avoided.

MONOPOLY DISPUTE.—With reference to the recent note on this subject (January 11th issue, p. 70), it is reported that a suit against the "Radio Trust" licences was to be heard in the United States Court at Wilmington, Del., on February 11th. The *Financial News* points out that the "Trust" has lost twice, and that the present suit is to make an injunction permanent. The case involves the alleged monopoly of radio valve licence contracts; the General Electric, Westinghouse, A. T. & T., and 27 other manufacturing companies have been named in the action.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 12th. Posts and Telegraphs Department. Telephone relays. (B.X. 5078.)*
April 2nd. Jumper rings and terminal strips. (B.X. 5066.)
March 18th. State Electricity Commission of Victoria. Insulators and accessories. (B.X. 4997.)*
April 8th. Galvanised steel transmission line towers. (A.X. 7401.)*
April 29th. Two or three steam turbo-generator sets with condensers for Yallourn Power Station extension. (B.X. 5062.)*

Aylesbury.—Electricity Department. Materials for 12 months, including cables, insulators, meters, joint boxes, &c. (February 8th.)

Bedford.—February 22nd. Electricity Department. E.h.p., h.p. and l.p. cables, incandescent electric lamps. (February 1st.)

Blackburn.—February 19th. Manchester Board of Guardians. Renewal of a 98-cell electric storage battery at the Colony for Epileptics, Langho. Particulars from Mr. E. Hargreaves, superintendent of works, Union Offices, All Saints', Manchester.

Bristol.—February 20th. Board of Guardians. Electrical fittings for six months. Mr. Thomas S. Lamb, clerk, St. Peter's Hospital.

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Dumfries.—February 21st. Electricity Department. One 1,500-kW turbo-alternator and condensing plant. (February 1st.)

Edinburgh.—March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuseboards, electricity supply meters. (See this issue.)

Egypt.—CAIRO.—March 27th. Ministry of Interior. Supply and installation of an electric lighting system for the town of Fashu. (B.X. 5037.)*
March 6th. Underground and overhead transmission line from the Mit Chamr electric power station to the town of Kom el Nour. (B.X. 5074.)*

Erith.—March 4th. Electricity Department. H.p. and l.p. cables, joint boxes, &c. (February 1st.)

Hastings.—February 25th. Corporation. Electrically-driven pumping plant for the Kent Street pumping station. Specification (£5) from the engineer, Mr. G. M. C. Taylor, of Messrs. John Taylor & Sons, Caxton House, Westminster, S.W.1.

Hove.—February 20th. Corporation. Electric lamps for 12 months. Schedules from the borough surveyor's office.

India.—March 1st. India Stores Department. 200,000 insulators, 49 drums dry core telephone cable, 500 tons g.i. wire. (See this issue.)

Lancaster.—February 18th. Electricity Department. 400/600-Ah station battery with reversible booster, automatic switchgear, &c. (February 1st.)

Leeds.—Electricity Department. March 9th. 2,000- and 6,600-V single-phase, and 3-phase (6,600-V) Scott-connected transformers for a period of two years; 11,000-V, 3-phase transformers. (See this issue.)

Linlithgow.—February 28th. District Committee. Erection of lamps and electric lighting fittings in the special lighting districts of Winchburgh and Kirkliston. Specifications from J. G. B. Henderson, district clerk.

Liverpool.—Water Committee. Electrically-driven pumping sets for the Aubrey Street pumping station. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)
March 2nd. 66,000-V and other transformers (London Area) in connection with the South-East England Electricity Scheme. (February 1st.) 33,000-V overhead line—Luton to Aylesbury—in connection with the South-East England Electricity Scheme. (February 8th.)
February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)
March 4th. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (January 18th.)
METROPOLITAN ASYLUMS BOARD.—February 20th. Installation of electric lighting at Southwark Casual Ward. (February 1st.)

London County Council.—February 26th. One 10-cwt. electric goods lift for the Hammersmith Building Trade School. (February 8th.)

Lourenco Marques.—March 19th. Port and Railways Board. 50-kVA Diesel-driven generating set and an electrically-driven water pumping set. (B.X. 5050.)*

Newcastle-upon-Tyne.—February 18th. Tyne Improvement Commission. One 1½-ton portal electric travelling level luffing crane. Specification (21s.) from Mr. A. Blacklock, secretary, Tyne Improvement Commission Offices, Bewick Street, Newcastle-on-Tyne.

Newton Abbot.—February 28th. Board of Guardians. Installation of electric lighting at the Institution, Newton Abbot. (February 1st.)

New Zealand.—Dunedin.—March 20th. Tramways Department. Tramway equipment. (A.X. 7441.)*

Northern Ireland.—Belfast.—February 18th. Electricity Department. Materials for 12 months, including electrical accessories, lamps, carbon brushes, cables, joint boxes, meters, &c. (February 1st.)
February 26th. Tramways Committee. Stores (including electrical accessories, carbon brushes, armature and field coils, &c.) for 12 months. (February 8th.)

Plymouth.—February 25th. Electricity Department. Electricity meters, cables, transformers, and sub-station switchgear. (See this issue.)

Roscommon.—February 23rd. County Board of Health. Electric lighting installation at Roscommon County Hospital. Specifications from J. P. Tierney & Co., consulting engineers, 44, Kildare Street, Dublin.

Rhyl.—February 26th. Electricity Department. 1,750 yd. 3-core e.h.p. cable, 1,100 yd. 4-core armoured cable, 1,750 yd. of telephone cable, e.h.p. switchgear, two 250-kVA static transformers, and l.p. switchgear.

South Africa.—Cape Town.—March 15th. City Council. Metal-clad switchgear. (B.X. 5004.)*
March 21st. 300-amp. fuses. (B.X. 5080.)*
Pretoria.—March 28th. Posts and Telegraphs Department. Telephone switchboard cords. (B.X. 5048.)*
Johannesburg.—March 4th. Town Council. 6,600-V switchgear. (B.X. 5087.)*

Southend-on-Sea.—March 4th. Electricity Department. 1,200 d.c. house-service electricity meters. (See this issue.)

West Ham.—February 18th. Education Committee. Installation of electric lighting at South Hallsville new school, Agate Street, Tidal Basin. (January 25th.)

Worsley.—February 23rd. Urban District Council. Electric lamps required during year ending March 31st, 1930. Form of tender from Mr. J. Howard, surveyor to the Council, Town Hall, Walkden, near Manchester.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£1,952).—W. T. Glover & Co., Ltd.
Transformers (£163).—English Electric Co., Ltd.
Switchgear cubicles.—New Switchgear Construction Co., Ltd. (£329); English Electric Co., Ltd. (£156); Ferguson, Pailin, Ltd. (£100).

Bradford.—
Electric lighting at schools.—Green Lane school (£534).; Lorne Street (£301); Priestman and Marshfield schools (£353); Usher Street (£395); Whetley Lane (£355).—W. P. Holt & Co. Thorpe school (Idle) (£208).—J. Carter. Hutton school (Eccleshill) (£267).—H. Simonett.

Burnley.—Electricity Committee. Accepted:—
Electric passenger lift at the Corporation electricity showroom (£514).—J. Bennie, Ltd.

Doncaster.—Town Council. Accepted:—
Extra-h.p. cables (£106).—Callender's Cable and Construction Co., Ltd.
L.p. cables (£369).—Enfield Cable Works, Ltd.

Durham.—County Education Committee. Accepted:—
Electric lighting installation at Brandon Colliery new Council school, Co. Durham (£370).—Falconar, Cross and Co., Ltd. At Usworth Colliery new Council school (£289). At Seaham Harbour new Council school (£167).—Simm & Richardson.

East Ham.—Electricity Committee. Accepted:—
1,500-kW motor-convertor (£4,370).—English Electric Co., Ltd. Machine panel (£430).—Bertram Thomas. Switchgear (£1,389).—A. Reyrolle & Co., Ltd.
Tramways Committee. Recommended:—
Two spare trucks (£300).—Brush Electrical Engineering Co., Ltd.

Finchley.—Electricity Committee. Recommended:—
Cooling tower and foundations (£2,336).—Premier Cooler and Engineering Co., Ltd.

Gillingham (Kent).—Town Council. Accepted:—
Cable for the extension to Rainham, Wigmore, and Hempstead (£7,807).—Callender's Cable and Construction Co., Ltd.
Cable covers (at 9d. per yard).—Concrete Utilities, Ltd.

Glasgow.—Health Committee. Recommended:—
Lighting installation in grounds of Mearnskirk Sanatorium (£3,358).—Alexander Anderson, Ltd.

Kirkburton.—
Installing electric lighting in business premises for the Industrial Co-operative Society.—H. C. Stringer.

Leeds.—Electricity Committee. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£4,753); Enfield Cable Works, Ltd. (£3,008); Macintosh Cable Co., Ltd. (£20,776); Hackbridge Cable Co., Ltd. (£1,865); Greenwich Cable Works, Ltd. (£4,119).
Tramways Committee. Accepted:—
10 tons tie bars (£13 10s. per ton).—William Bain & Co., Ltd.
1,000 yards earthenware conduits (£264).—Leeds Fireclay Co., Ltd.
Two miles trolley wire (12 7/16d. per lb.).—Thomas Bolton and Sons, Ltd.

Manchester.—Tramways Committee. Accepted:—
Tram rail bonds.—Forest City Electric Co., Ltd.; T. Bolton & Sons, Ltd.
Electricity Committee. Accepted:—
Electricity meters.—Ferranti, Ltd.; Measurement, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Education Committee. Accepted:—
Electric lift at High School of Commerce.—Waygood-Otis, Ltd.
Electric lighting installation at Apollo Street school centre.—Sudlow & Co.

Plymouth.—Health Committee. Accepted:—
Electric lighting at smallpox hospital (£257).—W. G. Heath & Co.

Ramsgate.—Town Council. Accepted:—
Re-wiring the electric lighting system at the Royal Victoria Pavilion (£137).—A. E. Pinto.

Tonbridge.—Urban Council. Accepted:—
Switchgear for a substation.—English Electric Co., Ltd.

West Lothian.—Education Authority. Accepted:—
Electric lighting at Broxburn R.C. School (£95).—Mr. C. V. Campbell.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, February 15th. Institution, Storey's Gate, S.W. 6 p.m. Annual meeting. Friday, February 22nd. Informal meeting. 7 p.m. "Electrical Precipitation." Mr. G. Baker.

British Electrical Development Association.—Friday, February 15th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Organising for Increased Sales—Spring Cleaning Season, 1929."

British Industries Fair, 1929.—Monday, February 18th to Friday, March 1st. White City, London, W., and Castle Bromwich, Birmingham.

Institution of Electrical Engineers.—Informal Meeting.—Monday, February 18th. Institution, London, W.C. 7 p.m. "Modern High Power Rectifiers: Their Development and Use." Mr. R. L. Morrison.

(Western Centre).—Monday, February 18th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Construction of the Grid Transmission System in Great Britain." Mr. Johnstone Wright and Mr. C. W. Marshall.

(Irish Centre, Dublin).—Thursday, February 21st. Trinity College, Dublin. 7.45. "The Erection of the Mechanical and Electrical Part of the Shannon Scheme." Dr. K. Ott.

(Mersey and North Wales (Liverpool) Centre).—Monday, February 18th. University, Liverpool. 7 p.m. Faraday Lecture: "How Electricity Does Things." Mr. Ll. B. Atkinson.

(North-Western Centre).—Tuesday, February 19th. Engineers' Club, Manchester. 7 p.m. "Voice-Frequency Telegraphs." Mr. W. Cruickshank.

(Sheffield Sub-Centre).—Wednesday, February 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Address by the President.

(Tees-side Sub-Centre).—Wednesday, February 20th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Ordinary meeting.

Institution of Electrical Engineers—*continued.*

(London Students' Section).—Friday, February 22nd. (Joint meeting with the Institutions of Civil and Mechanical Engineers). I.E.E. building, London, W.C. 6.15 p.m. "Standardisation." Mr. W. Ford.

(North-Eastern Students' Section).—Friday, February 22nd. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "The Progress of Electrical Installations on Ship Board." Mr. G. Waters.

Overhead Lines Association.—Wednesday, February 20th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. "Timber and Creosoting," Mr. C. Wade; "An Alternative Method of Wood Preservation," Mr. R. H. Herford.

Birmingham Electric Club.—Friday, February 22nd. Grand Hotel. 7 p.m. "Electricity in Agriculture." Mr. G. E. Britton.

Physical Society.—Friday, February 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Electrical Trades Commercial Travellers' Association.—Friday, February 22nd. Connaught Rooms, Great Queen Street, W.C. 7 for 7.30 p.m. Annual dinner.

Association of Mining Electrical Engineers (Lothians Branch).—Saturday, February 23rd. Philosophical Rooms, Edinburgh. Paper by Mr. G. A. McLennon.

(Western Sub-Branch).—Saturday, February 16th. Swansea. "Fault Localisation." Mr. S. T. Richards.

(South Wales Branch).—Saturday, February 2nd. Cox's Café, Cardiff. 6 p.m. Annual dinner.

Association of Supervising Electrical Engineers.—Saturday, February 23rd. Hotel Cecil, London, W.C. Annual dinner.

Notes.

Electrical Engineers' Ball.

The London Electrical Engineers' Ball was held at the Hotel Cecil on Friday of last week, and as usual proved an exceedingly enjoyable function. The occasion was a special one, as it represented the 25th anniversary. Some 750 invitations were issued, and we should think that the number present could hardly have been far short of that figure. All the ladies were presented with fancy handbags as a souvenir of the semi-jubilee. Messrs. Sillar, Hill and Kingsbury and their executive colleagues may once again congratulate themselves on a highly successful evening, very much enjoyed by all those present.

Newcastle Electrical Carnival.

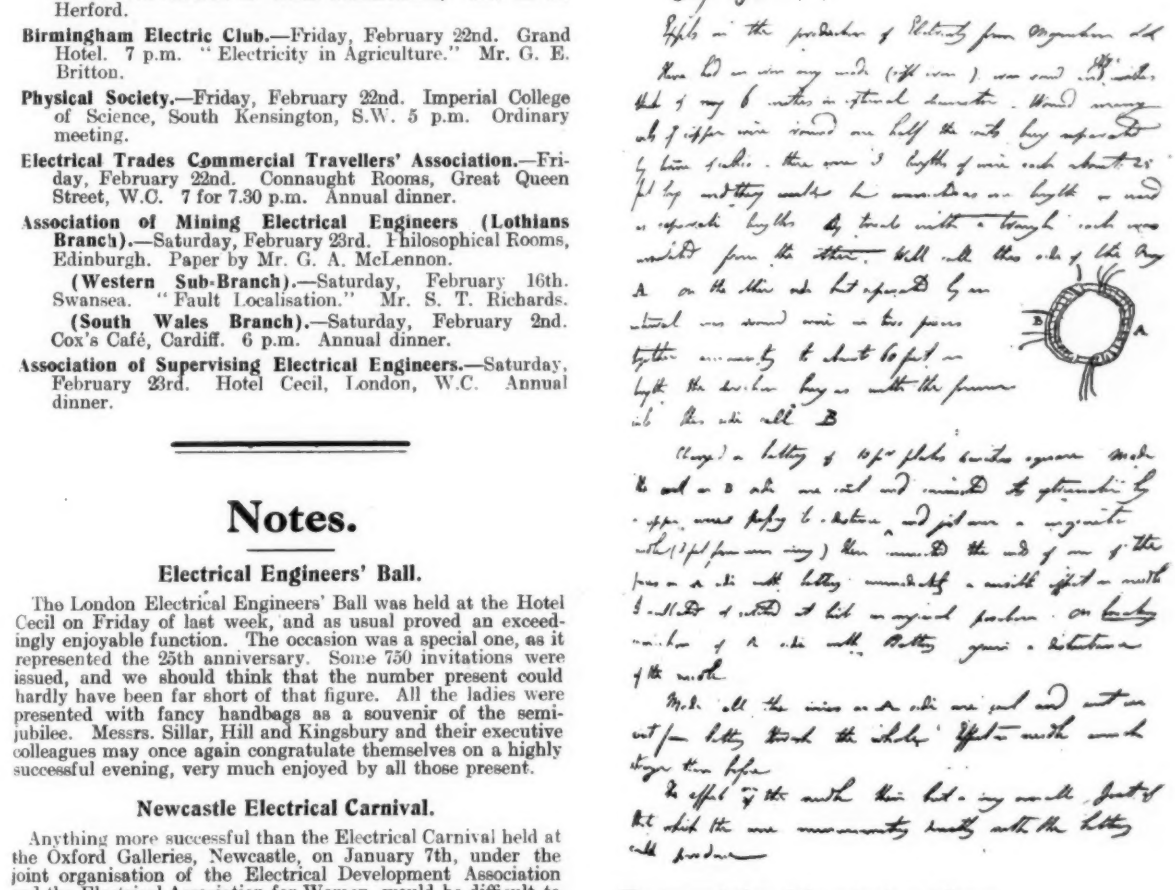
Anything more successful than the Electrical Carnival held at the Oxford Galleries, Newcastle, on January 7th, under the joint organisation of the Electrical Development Association and the Electrical Association for Women, would be difficult to imagine. Over one thousand guests attended the function, and were received by the Lady Mayoress of Newcastle, Mrs. Arthur Lambert. A shadowgraph competition, when well-known personalities in the electrical world passed before a screen, created great interest, and lovers of humour were excellently provided for. A cabaret, staged by the Misses Lazenby, of Newcastle, caused much merriment, while the climax of enjoyment was reached when a "mock wedding" was performed, the clergyman being let down through the ceiling. Over one hundred prizes were distributed, including electric fans, radiators, and table lamps. Those present included Mr. W. A. Walton, London (president of the Electrical Contractors' Association); Mr. Robson (chairman of the Newcastle Electrical Development Association); Mr. W. Horsfall (General Electric Co.); Mr. R. P. Sloan, Mr. L. C. Penwill, and Mr. J. Edgar (borough electrical engineer, South Shields). The proceeds of the dance are to be devoted to the hospitality fund for the two hundred delegates attending the E.A.W. conference at the North-East Coast Exhibition.

American Rural Line Recommendations.

In a publication of the National Electric Light Association (America)—"Serial Report of the Overhead Systems Committee, 1928-29," Engineering National Section, January, 1929 (price 40 cents)—are contained "Recommended practices for design and construction of rural lines." The recommendations, while not complete, are intended to embody the general features of rural lines and to point out where the construction may differ from that of the generally-accepted short-span construction used in lines constructed in urban territories. The present practice of various operating companies now serving rural territories has been used as the basis for these recommendations, together with the requirements of Handbook No. 3 of the U.S.A. Bureau of Standards (fourth edition of the National Electrical Safety Code). The recommendations in the main are general only, though they have been made somewhat more detailed where it seemed desirable. Such details of construction as tend to decrease the cost of the line without unduly sacrificing strength on tending to increase maintenance costs have been emphasised. The report is not intended to set up standards of construction, but to serve purely as a guide for rural line construction.

From Faraday's Notes.

The following is a photographic reproduction of a page of Faraday's notebook, and is of particular interest at the present time in view of the arrangements which are under consideration for the 1931 celebrations, referred to elsewhere in this issue :—



The transcription of the notes is as follows :—

August 29th, 1831.

Experiments on the production of Electricity from Magnetism, &c., &c.

Have had an iron ring made (soft iron), iron round and ¾ in. thick and ring 6 in. in external diameter. Wound many coils of copper wire round, one half the coils being separated by twine and calico—there were three lengths of wire, each about 24 ft. long, and they could be connected as one length or used as separate lengths. By trial with a trough each was insulated from the other. Will call this side of the ring A. On the other side, but separated by an interval, was wound wire in two pieces together amounting to about 60 ft. in length, the direction being as with the former coils. This side call B.

Charged a battery of 10 pairs of plates 4 in. square. Made the coil on B side one coil and connected its extremities by a copper wire passing to a distance and just over a magnetic needle (3 ft. from iron ring), then connected the ends of one of the pieces on A side with battery. Immediately a sensible effect on needle. It oscillated and settled at last in original position. On *breaking* connection of A side with battery again a disturbance of the needle.

Made all the wires on A side one coil and sent current from battery through the whole. Effect on needle much stronger than before.

The effect on the needle then but a very small part of that which the wire communicating directly with the battery could produce.

E.A.W. Activities.

The Electrical Outlet Campaign which was launched by the E.A.W. a year ago has undoubtedly done very much good work. A very successful meeting held in Newcastle on January 24th, was addressed by Miss Margaret Bondfield, M.P., and Mrs. L. A. Wilson. Miss Bondfield enthusiastically supported the campaign, and she said the time had arrived to do away with obsolete methods in the home, especially in the home of the working woman.

Fatalities.

An inquiry into the death of Robert Foreman Strang, electrician, Bathgate, who at Riddockhill colliery, accidentally came into contact with an electric switch, was held at Linlithgow on January 29th. The mine manager stated that dampness had affected the incoming cables and there was a slight breakdown. In consequence the cables were brought out an inch from the wall and Strang did the work. He gave him clear instructions that he was not to attempt to do anything until he was certain the power had been switched off. A foreman said he saw Strang standing on a cubicle slackening nuts. He had one hand on the wall while he did this and witness thought he was over-reaching himself. Strang put his right hand down to grip the ladder and his left hand came in contact with a switch that was carrying 3,000 V. A formal verdict was returned.

At Dunfermline on January 31st an inquiry was held into the death of a colliery labourer who received a fatal electric shock at Hill of Beath washery plant, Dalbeath Colliery, Cowdenbeath. The bing on which he was working was lighted by electricity, and an electric wire above snapped and fell on him. Under the system in use at the time a wire on the bing was "alive" when the lamps on the bing were out. The jury added to its formal verdict a recommendation that it would be conducive to safety that when lamps on the bing were not in use the electricity should be switched off from the wire on the bing.

Alternator Excitation.

There would appear to be divergence of views regarding the influence of the method of alternator excitation on the even operation of power-distribution systems. There are electrical engineers who consider that the best method of dealing with serious trouble in the distribution system is quick de-excitation of the synchronous alternators, while others prefer to maintain the pre-existing state of flux in the machine.

The subject was discussed at a recent meeting in Paris of the Société Française des Electriciens by Mr. Belfils, of the Société Alsacienne de Constructions Mecaniques, who drew a distinction between the even operation in parallel of the generators in a particular station and the even operation of both the generation and consuming installations. In the latter case, he said, the conditions varied according as the impedance of the consuming plant (motors) was a function of the system voltage or when it was independent thereof, as in the case of lighting and heating installations. Mr. Belfils summed up his remarks by the following four points:—

(1) That the even operation in parallel of the different alternators of a system did not necessitate a practical consistency of flux in the respective machines; on the other hand, such a condition might lead to other difficulties in the case of a short circuit.

(2) Except in the two cases of the utilisation of energy by one or several consuming units of which the apparent impedance dropped as the supply voltage fell away, and that of a power station with advancing power factor, the even operation of the whole of a distribution system was practically always assured.

(3) That it was desirable to get rid of short-circuits as quickly as possible, and that in many cases it was preferable that the generator flux should fall while it lasted, although the drop should not be a notable one.

(4) As soon as the short circuit had been overcome, it was always useful, and often indispensable, that the flux of the machine should be re-established quickly in order to prevent any interference with the operation of consuming units, particularly those which were sensitive to any variation in voltage. It was therefore desirable that generators should be provided with devices to secure that end.

Mr. Belfils is devoting further attention to the subject, and is now engaged in working out methods of excitation that will fulfil the conditions laid down in his paper.

Electrical Equipment at Sunderland Docks.

With the object of improving facilities for handling the increasing import traffic of the port of Sunderland, the River Weir Commissioners have recently installed four new five-ton electric cranes, supplied by Messrs. Babcock & Wilcox, Ltd. These cranes, which have a radius of 47 ft., are fitted with the makers' level luffing jib. Three additional three-ton electric cranes have also been installed at the East Quay.

Another interesting scheme which has been put in hand by the Commissioners is the conversion of Roker Pier lighthouse, one of the best known lights of the North-East Coast, to electric lighting, automatically operated. The fog siren, which is also situated in the lighthouse, is also to be worked automatically by electricity.

Australian Wiring Rules.

The Australian Commonwealth Engineering Standards Association has added to its activities the revision and administration of the electrical wiring rules for the Commonwealth. The work was taken over at the request of the Institution of Engineers, by whom the existing set of rules was issued, and the Association has decided that it will be necessary to make an analysis of the wiring rules existing in all important countries throughout the world. A Wiring Rules Sectional Committee is being established, which will operate in Sydney, with an advisory committee in each State.

Accumulator Standardisation.

A revised sheet of provisional standards in respect of the dimensions of battery crates or moulded containers, terminal posts, and cable connectors for the electric starting and lighting equipment of private motor cars has just been issued by the Society of Motor Manufacturers and Traders. The sheet gives the dimensions of five sizes of containers for both 6-volt and 12-volt batteries, ranging in capacity from 48 to 96 amp.-hours; it also gives the dimensions of terminal posts and drawings and dimensions of positive and negative cable connectors.

Electric Vehicle Progress.

The Ministry of Transport has just issued a return of the number of licensed motor vehicles in use in Great Britain at the end of September last, from which it is interesting to learn that, although they form but a small percentage of the total, there is a slow, but steady, increase in the number of electric commercial vehicles in use in this country. The return shows a total of 1,477 such vehicles, an increase of 114, or about 8 per cent., in twelve months. The total is made up of 168 vehicles for loads up to 25 cwt., 243 for carrying between 25 and 40 cwt., 233 between 2 and 3 tons, 466 between 3 and 4 tons, 289 between 4 and 5 tons, and 78 carrying over 5 tons, each division showing an increase.

Finsbury College Dinner.

The annual dinner of the Finsbury Technical College Old Students' Association is to be held on Friday, March 1st, at the Trocadero Restaurant, with the president, Mr. E. W. Moss, in the chair. As this event will celebrate the jubilee of the opening of Finsbury College, it is hoped that there will be a large attendance. Early application should be made for tickets (12s. 6d. exclusive) to the honorary secretary, Mr. F. R. C. Rouse, 15, Clifton Gardens, Golder's Green, London, N.W.11. Old students who are not already members of the Association are invited to get into touch with the secretary.

The Batti-Wallahs' Society.

On Wednesday, February 27th, the Society will hold its next luncheon at the Hotel Cecil at 12.30 for 1 p.m. Lt.-Col. K. Edgcumbe will be the chief guest, and his address will be on "Prosperity." On Friday, March 1st, the annual dinner and dance will take place at the Hotel Cecil. The reception by the president, Mr. R. W. Hughman, is at 7 p.m. and the dinner at 7.30 p.m.

Educational.

FARADAY HOUSE SCHOLARSHIPS.—The annual examinations for a Faraday scholarship, tenable for two years in college and one year in works, and for a Maxwell scholarship, one year in college and one in works (each of the value of 50 guineas), will take place at Faraday House, London, on April 9th, 10th, and 11th. Exhibitions may be awarded to candidates who acquit themselves creditably, but do not qualify.

UNIVERSITY OF LONDON.—A course of five lectures on "High Voltage Cables" will be given (in English) by Mr. L. Emanuel, of Milan, chief electrical engineer of the Pirelli Cable Manufacturers' Organisation, at the Institution of Electrical Engineers on February 20th, 22nd, 26th, March 1st and 5th, commencing at 5.30 p.m. Admission free without ticket. (See our advertisement pages to-day.)

Nickel-Plating Solutions.

A publication of the research and development department of the Mond Nickel Co., Ltd., "The Control of Acidity in Nickel-Plating Solutions," contains a copy of a paper, "The Acidity of Certain Electro-plating Solutions," by A. W. Hothersall, M.Sc., read before the Electroplaters' and Depositors' Technical Society. In the paper Mr. Hothersall explains that somewhat difficult term "pH," and describes the various methods used for its determination. He also adds some remarks on the need for acidity control and the use of buffering agents. No doubt, if no method of acidity controls is at present used, the adoption of one of the methods mentioned in the paper will lead to improved regularity and quality of product.

Appointments Vacant.

Installing engineer (300 taels per month) for the Shanghai Mutual Telephone Co., Ltd. Provincial sales manager for the Tungsram Electric Lamp Works (Gt. Britain), Ltd. Borough electrical engineer (£1,000) for the County Borough of Stockport. Junior scientific officer (£259) for the Admiralty Scientific Pool. Lecturer in engineering (£400) for the East London, South Africa, Technical College. Teacher for electrical drawing, demonstrator for advanced electrical machines, assistant instructor for installation workshop for the Hackney Technical Institute. Consumers' accounts and records clerk (£150), shorthand-typist, corerspondence and filing clerk (£110) for the Watford Corporation Electricity Department. Working manager for the Sidmouth U.D.C. Electricity Department. (See our advertisement pages to-day.)

Ex-B.W. Association Annual Reunion.

The next dinner and reunion of Ex-British Westinghouse men will be held at the Hotel Cecil, London, on Friday, March 8th. Particulars and tickets (15s. each, including one year's subscription) can be obtained from the honorary treasurer, Mr. W. E. Warrilow, 40, Mildred Avenue, Watford. Mr. F. Massingberd Rogers will preside.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting on February 4th (Mr. F. Pooley in the chair), Mr. W. Rawlings opened a discussion on "Earthing and the Safety of the Public." The importance of the subject was reflected in the very large gathering present, and so many wished to contribute to the discussion that it was necessary to enforce a five-minute time limit on each speaker; even so, a number were precluded from speaking. Mr. Rawlings said the public should know the risks that were liable to occur with electrical apparatus, and he did not fear that proclamation of the dangers and how to avoid them could do any harm to the industry. He stated that the reports of H.M. Senior Inspector of Factories showed that of fatal accidents ten were caused by a.c. circuits for every one by d.c. It was, therefore, obvious that regulations for d.c. supply were not sufficiently stringent for a.c.; yet many new connections were being made to a.c. services without regard to the precautions, or suitability of the apparatus. It was necessary everywhere, without exception, to earth all metal liable to become alive; he believed it would be cheaper in the long run, while there would be no difficulty about creating a large demand for three-pin plugs and portable apparatus provided with earthing terminals. He was prepared to agree with those who advocated the insulation of everything if it could be done, but until they can insulate small radiators, irons, vacuum cleaners, fans, &c., including the special light and violet-ray apparatus which was frequently installed in bath rooms, there would be no protection at the most dangerous points. Mr. Rawlings advocated a system of concentric wiring, and concluded with an appeal for publicity. He said knowledge of the dangers of electricity when mishandled would not alarm people. It was such an excellent servant that the public would have it and insist on the improved safeguards that could make it ideal.

Mr. A. H. Dykes was in full accord with Mr. Rawlings. With concentric metal-sheathed wiring an earth was obtainable at all points; earth currents were avoided, the cost of wiring was reduced, and safety assured.

Mr. Ll. B. Atkinson said the subject could not have too much publicity; people must be taught not to play with 230 V, and they could be taught in a way that would not alarm them. He thought too much already existed of systems and apparatus wired in other ways for a general and sudden enforcement of earthing rules, but it was not beyond hope that the Commissioners could ensure that all apparatus on sale should have provision for a third wire.

Dr. A. Ekström said that a.c. at 40 V was fatal to some human beings, and it was therefore imperative to provide protective devices. He showed lantern-slide diagrams of three-phase mains and protective resistances, and pointed out how difficult it was to find a suitable earth under certain conditions.

Mr. R. Borlase Matthews said the discussion showed extraordinary diversity of opinion. He pointed out how different earthing was in towns where water mains were available to country districts where it was frequently difficult to find a satisfactory earth. In Holland it was compulsory to instal a transformer and reduce the supply pressure to 25 V for hand lamps.

Messrs. J. J. Bacon, F. W. Blanchard, T. C. Gilbert, R. Grierson, B. Higgs, A. Kirk, S. W. Melsom, C. C. Paterson, O.B.E., Napier Prentice, F. C. Raphael, E. Ridley, and Major Smith also spoke.

Institution of Mechanical Engineers.

KINEMA FILMS.—On March 8th, at 7 p.m., it is proposed to hold an informal meeting of the Institution (Storey's Gate, St. James' Park, S.W.), at which a collection of recent industrial kinematograph films of engineering subjects will be displayed, including one on "Electro-Farming," by Mr. R. Borlase Matthews.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review posted concerning their movements.

After a long discussion at its last week's meeting the Manchester City Council refused to increase the salaries of a number of its principal officials, including the chief engineer and manager of the Electricity Department, Mr. H. C. LAMB, although Alderman Dagnall pointed out that Mr. Lamb had virtually been promised an increase "when he had proved his worth" upon succeeding Dr. S. L. Pearce.

The Eccles Town Council has increased the salary of the borough electrical engineer from £850 to £900 per annum.

The wedding took place last Saturday, at All Saints' Catholic Church, Hassop, near Sheffield, of Mr. DENIS ZIANI DE FERRANTI, son of Dr. and Mrs. S. Ziani de Ferranti, of Baslow Hall, Derbyshire, and Miss ELIZABETH ESPLINE THOMSON, of Bellevelle, Newark, U.S.A. Misses Yvonne Ziani, Yolande and Valerie de Ferranti and Miss Wanda Ord were the bridesmaids. After the ceremony a reception was held, and among the guests were Sir John and Lady Snell. Among the wedding gifts were an oak table from the employés and a case of cutlery from the staff of Messrs. Ferranti, Ltd.

The Massachusetts Institute of Technology invited Prof. Dr.-Ing. REINHOLD RUDENBURG, the chief electrical engineer of the Siemens-Schuckert Werke Gesellschaft, of Berlin, to deliver a series of public lectures at Cambridge, Mass, U.S.A., from February 5th to March 26th.

The *Daily Telegraph* states that Sir HUGO and Lady HIRST are expected back in London on February 22nd from Australia and New Zealand.

The Middlesbrough Town Council has increased the salary of the electrical engineer, Mr. R. H. SCOTSON, from £750 to £800 per annum.

Burnley Town Council is recommended to increase the salary of the electrical engineer, Mr. J. E. STARKIE, from £731 to £900 per annum.

Mr. R. HOGGARD, manager of the Lincoln Corporation Transport Department, who is leaving to take up a similar position at Chesterfield, has been presented by the tramway and 'bus employés with a silver tea and coffee service and a silver tray. From the city officials he received an electric lamp standard in oxidised silver.

At the works of Messrs. T. W. Broadbent, Ltd., at Huddersfield, on February 1st, a presentation was made to Mr. MAURICE EDWARD BROADBENT, only son of the founder of the firm (the late Mr. T. W. Broadbent), and a student member of the Institution of Electrical Engineers, on his coming-of-age. The workmen presented him with a suit-case, the gift being handed over by Mr. Law Brook, the oldest employé. Mr. G. A. Broadbent, chairman of the company, presented each workman with a monetary gift varying in amount according to length of service, ranging from 34 years down to 11 years.

On the occasion of the twenty-fifth anniversary of the London Electrical Engineers' Ball, Mr. A. M. SILLAR, who has acted as honorary secretary during the whole of the twenty-five years, was presented with a handsome silver Treasury-pattern inkstand, suitably inscribed. The presentation was made by Mr. J. E. Kingsbury during the dance, and Mr. Sillar expressed the gratification which he felt at this kindly recognition of his services.

Press reports state that only a few days after his return to New Zealand following a lengthy absence in England and Malaya, Mr. BEALE, H.M. Trade Commissioner in New Zealand, received instructions to return to London immediately to confer on urgent questions.

On February 4th, Alderman R. S. PILLING, J.P., chairman of the Colne Electricity Committee, was installed as W.M. of the Colne Lodge No. 4402 by the retiring W.M., Mr. J. H. Thompson, M.I.E.E., borough electrical engineer.

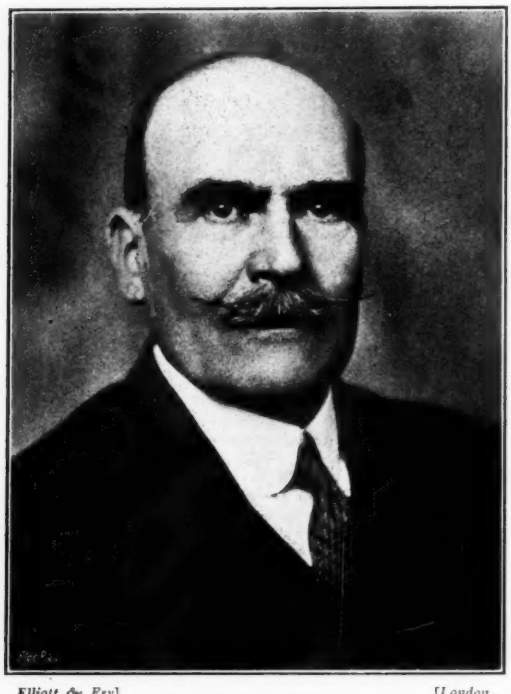
Mr. F. A. DRACUP has resigned his position as motors and hiring superintendent in connection with the Birkenhead electricity undertaking.

The retirement is announced of Mr. R. DUMAS, works manager at Rugby for the British Thomson-Houston Co., Ltd., a position he has filled since 1908. Mr. R. C. CLINKER, chief of the engineering laboratory, has also relinquished his position, and is succeeded by Mr. H. W. WARREN. Mr. Clinker joined the company in 1895 in London, and Mr. Warren joined the Rugby staff in 1911, and in 1913 went to Coventry; he was responsible for the introduction of insulation manufacture at both Rugby and Coventry.

At the end of February Mr. J. W. FAWCETT is severing his connection with the Holmfirth Urban District Council, with which he has been electrical engineer and manager for the past five years. He is taking up the position of resident engineer with the Electric Development and Securities Trust, Ltd., and will reside at Withernsea.

Mr. W. DALE, foreman mechanic at Burnley electricity works, who recently retired after 35 years' service, has served under four engineers and managers: Messrs. Thursfield, Wright, Birkett, and Starkie (the present manager). He has received a farewell presentation, consisting of an inlaid clock, from his colleagues.

We publish accompanying these notes a photograph of Mr. W. A. WILSON, who retired from the post of assistant to the general manager of British Insulated Cables, Ltd., in London, at the end of last year. Mr. Wilson joined the Contract Department of the company in April, 1901, as engineer. He supervised various contracts, including a complete network of h.p. cables in Amsterdam, and the laying and jointing of some 100 miles of 11,000-V feeders in connection with the electrification of the Underground Electric Railways. He was transferred to the commercial side of the company's business in



Elliott & Fry] [*London.*

Mr. W. A. Wilson.

1905 and placed in charge of a new branch opened by the company in Birmingham. He took over the management of the Scottish branch in 1906, and was appointed manager of the company's telephone instrument works at Liverpool in 1911. In the following year he was appointed commercial manager, involving the management of agencies and publicity, to which was added, on his transfer to the general manager's office in London in 1919, the role of assistant to the general manager, and he continued those duties up to the time of his retirement. His retirement, and the death of Mr. James Taylor, J.P., the late chairman, in September, 1927, have of necessity caused various changes in the staff appointments. Readers who are in personal touch with the chiefs of the various departments in British Insulated Cables, Ltd., will be interested in a list of the new appointments. On the death of Mr. James Taylor, Mr. Dane Sinclair, director and general manager, became chairman of the company; Mr. G. H. Nisbett, chief engineer and director, was made managing director; Mr. B. Welbourn, contract manager, was appointed chief engineer; and Mr. N. K. Bunn, assistant contract manager, was appointed contract manager. On the retirement of Mr. W. A. Wilson it was arranged that a committee should be appointed to take over his duties. The Committee is constituted as follows: Mr. R. B. Paul (agency manager), Mr. A. J. Macphail (publicity manager), Mr. W. P. Ward, Mr. L. J. de Wynter, Mr. C. E. Newton, Mr. E. A. Eaton (joint sales managers). Mr. C. E. Newton was, up to August, 1928, engineering representative at the London office. This appointment has now been taken over by Mr. N. H. Miller and Mr. E. A. Sayers.

Mr. J. H. DUTTON, of the Gloucester Electricity Department, has been appointed a junior charge engineer at Portsmouth generating station.

Obituary.—MR. A. H. ALLEN.—It is with feelings of deep sorrow that we have to state that Mr. Arthur Hinton Allen, M.I.E.E., Technical Editor and Director of the ELECTRICAL REVIEW, has passed away at the moment of going to press, after a very brief illness from pneumonia. He was in his 57th year. We shall refer to the matter further next week.

MR. H. T. GEORGE.—The death occurred at Margate on January 31st of Mr. Howard Trevelyan George, of Cardiff, late Senior Chief Assistant, X-ray Department, St. Bartholomew's Hospital, and Honorary Medical Officer in charge, X-ray department, St. Andrew's Hospital, Dollis Hill, London.

SIR JOHN COWAN.—On February 7th Sir John Cowan, chairman and managing director of Redpath, Brown & Co., steel constructional engineers, passed away in Edinburgh in his 85th year. Sir John was chairman of Bruce Peebles & Co., Ltd., and a director of Bolckow, Vaughan & Co., Ltd.

MR. F. BEARDMORE.—The death is announced, in his 61st year, of Mr. Frederick Beardmore, who was in business as an electrical contractor at Blackfriars Street, Salford.

MR. W. L. WILCOX.—The death took place on January 30th of Mr. William Langley Wilcox, who had for five years been electrician at Marlborough College. He was 42 years of age.

MR. G. M. BODDY.—The death occurred on February 8th, at the age of 73 years, after a short illness, of Mr. George Marlett Boddy, inventor of the Boddy Star and other life-saving jackets, and about twenty years ago connected with the manufacture and sale of electric lamps in this country.

MR. T. C. STEPHENS.—The death took place on February 2nd, at his residence, at Weston-super-Mare, of Mr. Thomas C. Stephens, superintendent at Weston for the Commercial Cable Co. He succeeded Mr. J. P. Gorton in this position in December, 1927, and he had been with the company for 40 years.

MR. J. GOBIN.—The death is announced at the age of 82 years of Mr. Joseph Gobin, who was for many years associated with the old Tramway Co. at Wigan; he was engineer prior to the trams being taken over by the Corporation.

Will.—The late Mr. R. A. DALZELL, formerly Director of Telegraphs and Telephones, left £2,741 gross and £2,606 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Polperro Electric and Cold Storage Co., Ltd.—Public company. Registered February 1st. Capital, £6,600 in £1 shares. Objects:—To adopt an agreement with the liquidator of the Polperro Electric and Cold Storage Syndicate, Ltd., and to carry on at Polperro and elsewhere in Cornwall the business of an electric light and power company, cold storage proprietors, &c. The directors are:—J. P. Briggs, 100, Langham Road, Teddington, architect; Lt.-Col. Sir Geo. A. E. Hussey, K.B., 29, High Street, Southampton; S. W. Taylor, Park House, Thames Ditton, dentist. Solicitors: Spring and Co., 13, Henrietta Street, W.C.2.

Pertrix, Ltd.—Private company. Registered February 1st. Capital, £10,000 in £1 shares. Objects:—To carry on the business of electricians, electrical and mechanical engineers and contractors, suppliers of electricity, and manufacturers of and dealers in primary and secondary electric batteries of all kinds, and to adopt an agreement with A.F.A. Accumulators, Ltd., for the purchase of the trade mark "Pertrix," and the acquisition of the business of that company in "Pertrix" batteries. The first directors are:—E. G. Lind, 20, Bryanston Mansions, York Street, W., chartered electrical engineer; J. F. Monnot, 36, Blandford Street, W.1, engineer. Registered office: 120, Tottenham Court Road, W.1.

Eirco (Wholesale), Ltd.—Private company. Registered in Belfast on January 18th. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical engineers, wholesale manufacturers of electrical equipment, dealers in wireless apparatus, &c. The subscribers are:—L. Scop.

37, Glandore Avenue, Belfast, electrical engineer; F. A. Newell, B.Sc., 1, Ashfield Crescent, Belfast, electrical engineer. The first directors are not named. Registered office: Kingscourt, Wellington Place, Belfast.

Aidsuneed, Ltd.—Private company. Registered February 2nd. Capital, £100 in 1s. shares. Objects:—To manufacture and deal in stoves, engines, and other conveniences calculated to promote the consumption of electricity, &c. The first directors (to number not less than two nor more than five) are:—R. F. Weekey, "Alameda," 22, Selwyn Road, New Malden; G. J. Bird, "Shirley," 7, Selwyn Road, New Malden, secretary; A. H. Bird, "Shirley," 7, Selwyn Road, New Malden, designer. Registered office: 35, Bucklersbury, E.C.

Dorian Wireless Co., Ltd.—Private company. Registered February 1st. Capital, £2,000 in 1,950 ordinary shares of £1 each and 1,000 deferred shares of 1s. each. Objects:—To carry on the business of merchants and manufacturers of and dealers in wireless, electrical, magnetic, telegraphic, telephone and other appliances, machines and apparatus, &c. The first directors are:—B. A. Emly, 5, Sheffield Terrace, W.8, managing director of Halcyon Wireless Co., Ltd. (life director); C. A. Gamlen, 25, Buckingham Chambers, Victoria Street, S.W.1, radio engineer. Solicitors: Kennedy, Lindo & Co., 79, Coleman Street, E.C.2.

Truphonic Radio, Ltd.—Registered as a public company February 4th. Capital, £75,000 in 2s. shares. Objects:—To acquire the undertaking of Truphonic, Ltd., and to carry on the business of manufacturers of and dealers in radio, television and electrical apparatus, gramophone, record and accessory manufacturers, importers and exporters, electrical engineers, &c. The first directors are:—Geo. E. Spero, 10, Lancaster Gate Terrace, Hyde Park, W.2 (chairman, Truphonic, Ltd.); J. H. Benjamin, 19, Lancaster Gate Terrace, W.2 (director, Truphonic, Ltd.); James A. Whatnall, 31, Fillebrook Road, E.11, consulting engineer; Lt.-Col. Sir Rhys Williams, Bt., D.S.O., 47, Eaton Place, S.W.1. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.2.

East Devon Electricity Co., Ltd.—Public company. Registered February 5th. Capital, £10,000 in £1 shares. Objects: To carry on the business of an electric supply company in all its branches. The first directors are: J. L. Walsh, 73, Prince of Wales Mansions, Battersea Park, S.W.11, solicitor; S. S. Grant, O.B.E., 12, Third Avenue, Hove, chartered electrical engineer; F. J. Bayley, 16, Hereford Square, Kensington, S.W.7, engineer. Solicitor: Horace Davey, 47, Parliament Street, S.W.1.

Emery & Co., Ltd.—Private company. Registered February 7th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, lighting, heating, wireless, mechanical and general engineers, &c. The provisional directors are:—E. W. Carryer, Friarswood House, Newcastle, Staffs., house furnisher; H. E. Emery, 61, Lower Street, Newcastle, Staffs., electrical engineer. Manager: H. E. Emery. Solicitors: Sproston & Son, Newcastle-under-Lyme.

Official Returns of Electrical Companies.

Hightensite and Ebonite Manufacturing Co., Ltd.—Third debenture dated January 24th, 1929, to secure £1,400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—Sir Robert L. Powell, J.P., Flowers Hill, Pangbourne.

Birmingham Mica Co., Ltd.—Particulars filed on January 26th, 1929, of £1,500 debentures authorised July 19th, 1928, charged on the company's property, present and future, including unpaid calls and liability of members, the amount of the present issue being £750.

Hambling, Clapp & Co., Ltd.—Debenture dated January 24th, 1929, to secure £1,700, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. H. Sayers, 14, Rectory Road, Beckenham.

Bower Electric, Ltd. (Old Company).—F. E. Kewley, 27, Grosvenor Court, Acton Hill, W.3, ceased to act as receiver or manager on December 31st, 1928.

Precision Radio & Manufacturing Co., Ltd.—Debenture dated January 26th, 1929, to secure £300 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. C. Powers, 56, Fleet Street, E.C.4.

Keswick Electric Light Co., Ltd.—Satisfaction to the extent of £550 on December 31st, 1928, of debentures created June 10th, 1901, securing £15,000, of which only £10,100 was issued.

Marple & Frisby, Ltd.—F. S. Wilks, 31, Lombard Street, E.C.3, was appointed receiver on January 28th, 1929, under powers contained in a debenture dated June 3rd, 1927.

Finston Manufacturing Co., Ltd.—C. O. Skey, of 10, St. Swithin's Lane, E.C., ceased to act as receiver or manager on January 28th, 1929.

South London Electric Supply Corporation, Ltd.—Satisfaction in full on December 21st, 1928, of trust deed dated February 2nd, 1909, securing £130,000.

Belbin & Bowden, Ltd.—Debenture dated January 28th, 1929, to secure £135 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. S. V. Bowden, 78, Brook Green, Hammersmith, W.

Midhurst and District Electricity Co., Ltd.—Debenture dated January 24th, 1929, to secure £5,000 and premium of 5 per cent. on the maximum amount at any time due charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Johnson and Phillips, Ltd., Columbia House, Aldwych, W.C.

Vidal Engineering Co., Ltd.—Particulars filed of £8,000 debentures authorised January 18th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £5,500.

T.V.E. (Triplex-Blade Ventilating Engineering) Co., Ltd.—Debenture dated January 29th, 1929, to secure £500 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. M. Kenny, 32, Nunnery Fields, Canterbury.

Rhyader Electric Light and Power Co., Ltd.—Capital, £2,000 in £5 shares. Return dated September 27th, 1928. All shares taken up. £2,000 paid. Mortgages and charges at date of return, £1,000.

Kartret Switchgear Co., Ltd.—Capital, £2,500 in £1 shares. Return dated January 4th, 1929. All shares taken up. £2,500 considered as paid. Mortgages and charges nil.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 7,000 ordinary and 3,000 preference shares of £1 each. Return dated November 21st, 1928. 4,200 ordinary and 1,800 preference shares taken up. £3,988 paid. £2,012 considered as paid. Mortgages and charges, £5,000.

S. Barnett & Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated December 24th, 1928. 807 preference and 950 ordinary shares taken up. £1,007 paid on 807 preference and 200 ordinary shares. £750 considered as paid on 750 ordinary shares. Mortgages and charges, nil.

Mawdsleys, Ltd.—Capital, £20,000 in 13s. 4d. shares. Return dated November 7th, 1928. 26,525 shares taken up. £9,683 6s. 8d. paid. £8,000 considered as paid. Mortgages and charges, £10,665 5s. 9d.

City Notes.

Yorkshire Electric Power Co.

The accounts for the year ended December 31st last show a net profit of £310,070 (after the payment of debenture charges), as compared with £294,371 in the preceding year. To this is added £74,096, making £384,166. A final dividend of 5 per cent., making 8 per cent. for the year, is recommended; £100,000 is to be placed to general reserve (making £475,000); and £78,233 is to be carried forward. The report states that the demand for electricity has again increased notwithstanding the trade depression, particularly that of the coal industry. The increase in the net profit was principally due to further economies resulting from the greater use of the Ferrybridge power station. There has been a substantial increase in the demand for supply in bulk, and a number of important new agreements have been made for additional supplies. A large number of mains extensions were made during the past year and others are in progress. The initial plant installed at Thornhill power station has now been removed to make room for larger and more efficient plant. The cost has been met out of reserves. In February last, 897,000 ordinary £1 shares were issued to the shareholders at 24s. per share. 20,000 6 per cent. cumulative preference £1 shares have been set aside to enable the company's employés to increase their interest in the company. Applications have been made to the Electricity Commissioners for authority to supply in parts of the counties of Derby, Lincoln, Nottingham and York (East Riding). These await decision. The parts in question adjoin the company's existing area of supply.

London Power Co., Ltd.

Mr. W. F. Fladgate (chairman) presided at the annual meeting on February 8th and said that the company was now operating all the stations taken over and by laying the 22,000-V mains it had completed the first portion of the programme. Although the output had shown a large increase they had been able to reduce their total charges for it, giving the constituent companies an actual cash benefit of £152,000. As a proof of the benefits of the combined system, the chairman said that although during the floods early in 1928 one of their stations had been put out of action, there was actually no interruption of supply. Even more important were the economic effects. In 1924 the average operating cost of the ten companies was 0.55d. per kWh; last year the company's average cost was 0.278d. per kWh, and by the end of this year he hoped that this figure would be reduced to 0.225d. The work at the Deptford West station was progressing and the station would be in commission, to some extent, before the end of the year. They would at once proceed with the work at the Battersea station, which would give them a further ultimate capacity of 400,000 kW. Four of their stations had been "selected" by the Central Electricity Board under the South-East England scheme, and the two new stations were also "selected" stations. With reference to the London and Home Counties Joint Electricity Authority, its proposal to ask Parliament for further powers had been actively and successfully challenged by the County of London Company. In his opinion it would be necessary for the company to appear before the Committee of the House, if the Bill should ever arrive there, to protect the position secured to the company by its Act. Mr. Fladgate concluded with a reference to the Holborn explosion and stated that the company's chief engineer had given evidence before the commission of inquiry.

The "Underground" Group.

The companies forming the London Underground Railways group last week declared dividends as follows:—

Central London Railway Co.—Final dividend of 2½ per cent. on the undivided ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); final dividend of 2 per cent. on the preferred ordinary stock, making 4 per cent. for the year as for 1927; dividend of 6 per cent. on the deferred ordinary stock (against 4 per cent. for 1927). The reserve receives £40,000.

London Electric Railway Co.—Final dividend of 2½ per cent. on the consolidated ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927). The allocation to reserve is £157,198.

Metropolitan District Railway Co.—Final dividend of 2½ per cent. on the ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); £90,000 to reserve.

City and South London Railway Co.—Final dividend of 2½ per cent. on the consolidated ordinary stock, making 5 per cent. for the year (against 4 per cent. for 1927); £25,000 to reserve.

London and Suburban Traction Co.—The directors state that they are unable to recommend the payment of a dividend on the 5 per cent. cumulative preference shares.

Underground Electric Railways Co. of London, Ltd.—Final dividend of 4 per cent. on the ordinary shares, making 7 per cent. for the year (against 5 per cent. for 1927). The "carry forward" is increased from £169,762 to £262,804.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Altrincham Electric Supply, Ltd.—50,000 cumulative participating ordinary shares of £1 each, fully paid, Nos. 56,651 to 106,650; 140,000 deferred shares of 1s. each, fully paid, Nos. 49,651 to 189,650.

London Power Co., Ltd.—£3,000,000 new 5 per cent. redeemable debenture stock, issued at £99½ per cent., partly paid and fully paid (February, 1929, issue).

Sofina (Société Financière de Transports et d'Entreprises Industrielles, S.A.).—3,750 ordinary shares of 500 fr. each, fully paid, Nos. 68,164 to 71,913.

Underground Electric Railways Co. of London, Ltd.—1,475 new ordinary shares of £1 each, fully paid, Nos. 7,056,721 to 7,058,195.

New Issue.

Truphonic Radio, Ltd.—The registration of this company is recorded in the "New Companies" section of this issue. Last week the company offered for subscription 425,000 shares of 2s. each at par. Of the balance 225,000 shares are to be issued as fully paid to the vendors, who also have an option of purchasing the remainder (100,000) at 2s. 6d. each. The company is to carry on the manufacture of portable radio receivers, loud speakers, electric gramophones, &c. It is expected that £30,000 of the proceeds of the issue will be available as working capital. The registered office of the company is at 121, Rosebery Avenue, E.C.1.

Lanarkshire Tramways Co.

The company has applied for sanction to abandon its tramways, substituting omnibuses, and changing its name to "The Lanarkshire Traction Co." The reasons for this are stated to be that the company has suffered severely from unrestricted and unfair competition, with the result that it is unable to earn a return upon its capital.

Singapore Traction Co., Ltd.

Speaking at the annual meeting on February 6th, the chairman (Mr. L. W. Hawkins) said that it was satisfactory to find that the company had again become able to pay a dividend (5 per cent. on the cumulative preference shares). The position during 1928 was much better than in the preceding year when a boycott of the company's services took place. During the first sixteen weeks of the current year the number of passengers carried and the receipts showed an increase of 25 per cent. There was good evidence that the company had not yet reached "saturation" and the policy of development was fully warranted. The directors consider that the reconstruction of the old company and the conversion of its almost derelict tramway had been fully justified. They looked forward to steady progress based on efficient catering to the public needs.

St. James' and Pall Mall Electric Light Co., Ltd.

The report for the year ended December 31st last shows a net profit of £103,851 (against £123,933 for 1927). To this is added £81,807 brought forward, making £185,658. The final ordinary dividend is 9.949d. per share, making up the "standard" dividend of 1s. 6.949d. per share for the year. £13,282 is transferred to special reserve fund "ordinary shareholders' benefit under the 'sliding scale' for the years 1926, 1927, and 1928," and £112,377 is carried forward. During the year the connections rose from 31,733 to 35,626 kW and the sales of energy from 28,414,097 to 32,322,499 kWh. The report refers to the death of Sir A. B. W. Kennedy, who was a director and chief engineer of the company, and to the appointment of Lord Wargrave to the board. Meeting: February 26th.

Everlite, Ltd.

The Marquis of Winchester (chairman) presided at the statutory meeting of the company on February 4th. In the course of his speech he said that the company had acquired ample accommodation in a factory acquired by Metropole Industries from Imperial Chemical Industries, Ltd. One of the largest metal lamp manufacturing concerns in the country had arranged to co-operate with the company; commencing with 40,000 lamps a week, the company would supply, in due course, as many as 100,000 a week. After referring to the circumstances in which Mr. S. R. Mullard resigned from the board, the chairman said that Mr. G. Langford had been appointed factory manager at Waltham Abbey.

West Highland Water Power Co.

This company has applied to the Secretary of State for Scotland for incorporation. The initial capital will be £1,000,000 and powers will be taken to double this figure. The borrowing powers will be limited to half the amount of the issued capital. The first directors of the company are Lord Meston, the Hon. R. H. Brand, and Mr. P. J. Pybus. These gentlemen and Sir Charles E. Ellis and Sir George E. May are the promoters of the scheme. The company proposes to construct and operate hydro-electric works at Glenelg, Inverness, and supply electricity at a maximum price of 1½d. per kWh. The works would be completed within 10 years.

Power Securities Corporation, Ltd.

The gross income for the year ended December 31st last rose from £111,796 to £123,159, and after meeting all expenses there was a net profit of £85,239 (against £84,678). To this is added £15,630 brought forward, making £100,869. The reserve receives £20,000 and the dividend equalisation fund £10,000; it is proposed to pay an ordinary dividend of 7 per cent. (as for 1927), and to carry forward £14,869. The directors state that the investments have an aggregate value in excess of the figure shown in the accounts. The company holds the entire share capital of Balfour, Beatty & Co., Ltd. Meeting: February 20th.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

Particulars of the proposed reconstruction scheme were published last week. It was shown that the total losses were £14,117,537. To meet these £9,499,688 of the share capital (£10,012,500) is to be cancelled. The loan capital is to be reduced by £3,363,986; interest, amounting to £988,468 is to be cancelled; and £76,098 is to be taken from the reserve. A number of other arrangements are to be made and the existing company will become a holding company with interests in eight engineering, shipbuilding, and colliery concerns.

Tyneside Tramways and Tramroads Co.

The report for the half-year ended December 31st last shows that the expenses exceeded the receipts by £1,049, and after providing for debenture interest, &c., the total deficit is £2,530. Against this are set a balance of £61 brought forward and £2,500 from the general reserve, leaving £31 to be carried forward. The traffic receipts for the whole year showed a decrease of £3,181, the number of passengers carried falling from 6,686,216 to 6,615,942. The car-mileage, however, rose from 549,642 to 551,275. The company has deposited a Bill with the object of obtaining powers to abandon the whole or any part of the tramways and to run omnibuses instead of, or in addition to, the tramway services.

Electrical and Industrial Investment Co., Ltd.

This company, which is controlled by the British Electric Traction Co., reports a profit of £22,147 for the past year (against £19,454). A dividend of 6 per cent. is to be paid on the deferred ordinary shares and £3,748 is transferred to the undivided profits account. A sum of £85,500 has been capitalised and distributed as a bonus to the deferred ordinary shareholders in the form of 1,710,000 fully-paid 1s. deferred ordinary shares. The whole of the issued and unissued deferred ordinary shares have been consolidated into £1 shares. Since the close of the year 10,000 £1 deferred ordinary shares have been subscribed at par, making the total issued 100,000. Meeting: February 19th.

Bankside Investment Trust, Ltd.

This trust offered for subscription on Monday last £700,000 of 5 per cent. first mortgage debenture stock at 97½ per cent. The prospectus showed that the company has an authorised capital of £250,000; of this £200,000 has been issued, the City of London Electric Lighting Co., Ltd., holding £199,991. It was formed in 1920, as a private company, to acquire and develop lands and buildings and to carry on other business projects. The payment of interest and sinking fund instalments is guaranteed by the City of London Electric Lighting Co., Ltd., and shareholders in that company were to receive preferential consideration.

Atlas Light and Power Co., Ltd.

It is reported that the company has entered into an agreement with the American and Foreign Power Co. for the sale of the Atlas electricity supply and tramway holdings in Argentina. The sum involved is £8,500,000. The company's other South American holdings will be retained. One of the conditions of the sale is said to be that British manufacturers shall be given preference in the placing of orders for equipment for at least ten years.

Fife Tramway, Light and Power Co., Ltd.

Presiding at the annual meeting on February 7th, Mr. William Low (chairman) said that on the power and lighting side of the business, which had contributed approximately 65 per cent. of the total trading profit, the improved results were undoubtedly attributable to the steps which had been taken to develop the outlying districts of the area of supply and to popularise the use of electricity by domestic consumers.

City of Buenos Ayres Tramways Co. (1904), Ltd.

The balance of net revenue for the past year is £73,345 (as compared with £74,885 for 1927). As previously announced, the final dividend is 1s. 3d. per share, making 5 per cent. for the year, £10,000 is placed to amortisation and general fund, and £1,345 is carried forward.

Ruths Steam Storage.

To operate the Ruths steam accumulator patents in the United States, Ruths Steam Storage, Inc., has been formed in New York with a capital of $1,500,000. A Canadian company, Ruths Steam Storage (Canada), Ltd., has also been formed, with a capital of $300,000 to exploit the Canadian rights.

Yorktown (Camberley) and District Gas and Electricity Co.

The directors recommend dividends at the rate of 12½ per cent. per annum on the original shares, and at the rate of 8¾ per cent. per annum on the additional shares (including the interim dividend already paid).

American Power and Light Co.

The regular quarterly dividend of 25 cents per share has been declared on the common stock.

Crossley Bros., Ltd.

The balance of the dividend on the 7 per cent. cumulative preference shares is to be paid for the year ended December 31st last. No dividend has been paid on the ordinary shares since 1920.

North Metropolitan Electric Power Supply Co.

The directors recommend a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year, as in 1927. £120,705 is to be placed to reserve, leaving £28,202 to be carried forward, compared with £19,041 brought in.

British Columbia Power Corporation.

The directors report that the net earnings for the six months ended December 31st last amounted to £441,479, an increase of £50,676 over the figure for the latter half of 1927.

Radio Corporation of America.

The total revenue for the past year rose from $65,082,074 to $100,530,720, and the surplus from $8,478,320 to $18,983,394.

Stocks and Shares.

MONDAY EVENING.

THE raising of the Bank Rate from 4½ per cent. to the present level of 5½ per cent. came as a complete surprise to the Stock Exchange markets, and had the immediate effect of upsetting prices in most departments. There was no great amount of selling, but jobbers frankly admitted that they marked down prices as a matter of precaution. The depression spread throughout the investment and the speculative markets alike, the only important department of the industrial market which was not affected being that for cable equipment shares, the prices of which show pronounced strength. Most of the issues connected with the United States gave way sharply, and General Electrics, from their recent high estate of 75s., fell back to 62s. 6d. The Underground group of railways announced their dividends at the end of last week and as the distribution on Underground Electric shares was no more than 7 per cent., this served to accentuate the dullness which prevailed in Home Railways. Marconis, after being noticeably strong, relapsed on sales which were made by those who feared that the rise in the Bank Rate would bring in a wave of profit-taking.

Tube Railway Dividends.

The Underground Electric Railways Company of London announces a final dividend of 4 per cent., making 7 per cent. for the year 1928, which is an increase of 2 per cent. as compared with the 1927 results. As mentioned here on many occasions, the market expectations of this dividend had been gradually rising during the past six months, and from 6 per cent. they went up as high as 10 per cent., though the cautious folks pinned their faith to 7½ per cent. That the actual rate should be below that last-named figure is regarded as a disappointment; and, in consequence, the shares fell from 27s. 6d. to 26s. The six per cent. income bonds shed 5 points on top of their fall of 2 in the previous week.

The Metropolitan District dividend, making 5 per cent. for the year, is up to anticipation. This shows a rise of 1 per cent. as compared with the previous year, and, as the allocations are satisfactory, the result is regarded as being good; the price of the stock remains at 80½. The London Electric, City and South London, and Central London Companies are paying 5 per cent. for 1928, as against 4 per cent. for 1927. Central London deferred gets 6 per cent., as against 4 per cent. The London General Omnibus dividend of 8 per cent. for the year, tax free, is 1 per cent. up, and the Associated Equipment Company pays a similar rate—*viz.*, 8 per cent.

Atlas Advance.

Atlas Light and Power shares have fully justified the optimism of the company's supporters, and, with a jump of several shillings, touched 1½. It was but recently that the company made a new issue of shares, offered to its own proprietors, at 40s. for a unit of one ordinary and one preference. This was so near to the market price, at the time the new money fell due, that some of the shareholders thought the offer not worth acceptance, particularly as the value of the rights was quoted as being virtually nil. The dramatic rise last week is due to an offer of 8½ million pounds sterling, by the American and Foreign Power Company of New York, for the Atlas Company's holding in Argentine electric tramway and electric supply undertakings. Anglo-Argentine Tramways first preference shares are 2s. 6d. higher, on anticipatory hopes. Dealings have now started in the shares of the Sofina Company, of which details were given last week, on page 250. Sofina controls, or is interested in, a number of electrical concerns, and is said to have cash resources amounting to ten million pounds sterling. The opening price for the share of 500 Belgian francs was £206. First circles acquired the shares very much more cheaply.

Electric Supply and Power.

The London Power Company was lucky in offering its three million pounds of 5 per cent. debenture stock, at 99½, on the day before the Bank Rate rose to 5½ per cent. No doubt the latter consideration affected the public result of the issue, and underwriters have been left with 47 per cent. of their obligation. The stock is a perfectly safe investment, and its security as absolute as most people require, but the price of issue looked high even with a 4½ per cent. Bank Rate, and the opening price was ¼ discount. County of London Electric ordinary have been a good spot, rising 2s. 6d. to 52s. North Metropolitans advanced to 50s., to the accompaniment of the now-familiar rumour of American buying for purposes of control. The company's new shares stand about 6d. less than the old. Various dividends at what are now regarded as the standard rates have been declared by the group of London electricity supply companies, prices remaining unchanged. London Electrics have gained 6d. at 26s. 6d. In the provincial list, Bournemouth and Poole are 3s. 9d. higher at 73s. 3d. Yorkshire Electrics are maintained at 36s. 6d.; the report shows a reduction in the allocations to reserve, an increase in the carry-forward, and the usual 8 per cent. per annum dividend on the increased capital.

Cable Stocks and Money.

Money rates must play a fairly important part in the values of Stock Exchange securities standing so high as do those of the Eastern Cable quartette. The 5½ per cent. Bank Rate has had, as might be supposed, an unfavourable effect upon all four issues, Globes, Eastern Extensions and Westerns being each 10s. down, Eastern Telegraph ordinary stock losing 2½ points. It is thought that the delay in the issuance of details as to how the existing stocks and shares will fare, in the distribution of the new securities, may be due to some technical point not yet wholly settled between the British Government and one of the Australian Colonies. There is no suggestion of a hitch having occurred: the negotiations have gone too far for such a thing to happen. But until complete and absolute unanimity are assured on every detail, it is thought that the exchange of the Communication Company's stocks may be held back. Marconis are 1/16 easier after their previous rise. Marines are 3⅛; Canadians dull at 32s. 6d. Great Northern Telegraphs lost 30s. of their recent very substantial improvement. Anglo-American Telegraph deferred dropped half a point, and at the middle price of 24½ the stock looks cheap, on its well-secured yield of 6⅛ per cent. on the money.

The Radio Corporation accounts for 1928, presented with admirable promptitude for so considerable an undertaking, show a surplus of 19 million dollars of receipts over expenditure. The 1927 surplus was 8¼ million dollars. The figures just announced give a key to the reason for the big rise that has taken place in the prices of the shares during the past few months. The "A" shares are about £78, and the "A" preferred £11 15s.

Strength of Equipment and Construction Shares.

From New York it is announced that the Associated Gas and Electric Company, a holding concern, has contracted to acquire control of the General Gas and Electric Corporation, which gives utility services in half-a-dozen important American States. It is said that the corporation thus formed will have gross annual earnings of more than 13 million pounds sterling.

The influence of New York as a bull point has been, however, somewhat blunted by the monetary developments, and there have been sharp falls in a good many American industrial shares.

General Electrics have come down to 3⅛, as already noted, and people who would not listen to a suggestion, when the market was strong, that the shares were standing too high, are now asking whether it might not be as well to sell. Other shares in the industrial list are generally good, rises having occurred in Enfield ordinary, Callender's, British Insulated, which are up 5s., British Aluminium, and Johnson and Phillips. The Stock Exchange Committee has given permission to deal in 150,000 new Callender shares, which were issued, it is said, to a financial house, though the price which the company received is not stated. We may add that shares were allotted to certain people in the City at 3⅛, and this is no doubt higher than the price which the later buyers paid. Possibly the company has some special reason for not allowing its shareholders the opportunity for acquiring new shares at what must have been a tempting price.

Armstrong's Loss.

Amongst the lower-priced shares, India Rubber and Gutta Percha are 1/16 better at 12s. 6d., and in the engineering group Babcock & Wilcox strengthened to 72s. The Armstrong Whitworth reconstruction scheme proposes the writing off of £14,117,536 as being lost or unrepresented by assets. The very magnitude of the sum has a kind of numbing effect, for nobody can visualise the amount of personal suffering which the loss inflicts upon many hundreds of genuine investors. Vickers are easier at 12s. 3d.

Miscellaneous Movements.

Manila Electric 5 per cent. gold bonds are 13 points higher at 102. Brazilian Tractions at 70 show a nominal fall of 9, but half of this is accounted for by the deduction of the value of the rights. Mexican Light and Power common shares are 2 down at 98; the 7 per cent. preferred at 78½ have gained a similar amount. British Electric Traction deferred stock holds its extraordinary level of 825, and stock changed hands twice to-day, Monday, at 810 and at 820. The Bombay riots led to a little heaviness in the prices of Indian shares, though prices were not quotably changed. According to the newspaper reports, the trouble is well in hand, and unless it should spread unexpectedly, the prospects are regarded as being favourable to early restoration of order. Hydro-Electrics are 38⅛, after being better. The British Columbia Power Corporation, which took over the British Columbia Electric Railway Company, announces an increase in net earnings, for the six months, July 1st-December 31st, 1928, of £50,676, which is considered satisfactory. The "A" shares stand at 58, and the "B" shares at 38. The Electrical and Industrial Investment Trust's profit of £22,148 for 1928 was £2,700 up, and the deferred ordinary shares will receive 6 per cent. dividend. It is proposed to convert these shares into deferred ordinary stock. The company's 4½ per cent. debenture stock is quoted at 62½. Rubber and rubber shares show no fresh indications of activity, although the statistical position is notably better than that of a year ago.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	1927.	Price Feb. 11, 1929.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	7s/3	+3/16	... ...
Brompton Ordinary	1	8⅜	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6xd.	—	5 2 10
Chelsea	1	8⅜	8⅜	27/-	—	5 3 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	52/-	+2/6	2 17 8
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	26/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/6	+6d.	5 5 8
Metropolitan	1	8	9	46/3	—	3 18 1
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	1	—	15	2 1/16	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26.6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	28/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 2
South London	1	8½	8½	27/6	—	5 2 4
Urban Ordinary	1	7	7	40/9	—	... ..
Westminster Ordinary	1	8⅛	8⅛	27/-	—	5 5 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/9	+6d.	6 1 8
Yorkshire Elec.	1	8	8	38/6	—	4 7 6

†4% of which was tax free.

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	8	8	65½	—	5 6 10
do. District	,,	3½	4	80½	+⅛	6 4 8
Underground Electric	£1	1½	5	28/-	—1/6	5 7 8
do. do. Income ...	Bonds	6	6	124	—5	4 16 9

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24½	—⅛	6 2 5
Automatic Telephone	1	10	10	2 1/16	—1/16	4 16 10
Eastern Extension	10	10	10	27	—⅛	*3 14 1
Eastern Tel. Ord.	Stock	10	10	270	—2½	*3 14 1
Globe Tel. and T. Ord.	10	10	10	26½	—⅛	*3 15 6
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	20	33	—1½	... ...
Indo-European	25	10	10	54½	—	*4 11 0
Marconi	10/-	5	*10	3 1/16	—1/16	... ...
Marconi-Marine	1	8½	12½	3⅜	—	3 9 1
Oriental Telephone Ord.	1	12	12	3	—	... ...
Western Telegraph	10	10	10	27	—⅛	3 14 1

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅜	+⅛	7 6 8
do. do. 2nd. Pref. ...	5			3⅜	—	3 5 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	825	—	... ...
do. do. Pref. Ord.	,,	3	3	126	—	6 7 0
Brazil Traction	100	6	7	70xr	—4½	3 17 2
Brit. Colombia Elec. Rly. Pce. ...	Stock	5	5	95½	—	5 4 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	84	—	5 19 1
Mexican Light Common	100	Nil	Nil	98	—2	... ..
do. 7% Pref.	100	Nil	7	78½	+2	8 18 4
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ..

Manufacturing Companies.

Babcock & Wilcox	1	13	15	72/-	+9d.	*4 3 4
British Aluminium Ord.	1	10	10	47/6	+6d.	*4 4 2
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅜	+⅛	3 1 6
Brush Ord.	1	10	10	28/9	—	6 19 9
Callenders	1	15	15	4 1/16	+1/16	3 9 1
do 6½% Pref.	1	6½	6½	1⅛	—	5 4 0
Crompton Parkinson Ord.... ...	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 8% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	23/9	—	5 16 6
Enfield Cable Ord.	1	20	20	7⅜	—1/16	3 14 6
English Electric	1	Nil	Nil	8/9	—	... ..
do. do. Pref	1	3	Nil	10/-	—	... ..
Gen. Elec. Pref.	1	6½	6½	21/6	—	5 6 1
do. Ord.	1	7½	10	3⅜	—1/16	3 4 0
Henley	1	25	25	6⅜	+⅛	4 1 8
do. 4½% Pref.	5	4½	4½	4⅜	—	5 8 0
India-Rubber	1	Nil	Nil	12/6	+1/16	... ..
Johnson & Phillips	1	12½	10	2 1/16	+1/16	4 17 1
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	19	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

The British Industries Fair.—I.

Functions and Exhibits in London and Birmingham.

ON Monday next at the White City, London, and at Castle Bromwich, Birmingham, the British Industries Fair will open its doors, and if present expectations are realised many orders will be placed by visitors from all parts of the world or by their representatives stationed in this country. It is particularly hoped that there will be a continuous hum of trading activity, including the making of new connections and the cementing of existing business relations, in the Electrical Section at Birmingham, for there has been no lack of enthusiasm among British electrical manufacturers in preparing appropriate and representative displays of their products. As we have already given a good deal of information in our pages regarding the Section and its arrangements, it should be needless to recapitulate all the details now. Briefly, however, it may be stated that both sections of the Fair are larger than ever, and in all some 2,000 firms have taken accommodation.

The Birmingham Section, with which we are more particularly concerned, has shown almost phenomenal growth in the last four years. The available space in 1926 was 185,000 sq. ft.; in 1927 it was 255,000 sq. ft.; and last year 345,000 sq. ft. This year there is an area of approximately 400,000 sq. ft., or nearly 12 acres, all of which is continuous and under one roof. Some idea of the size of the exhibition is conveyed by the fact that it has been necessary to provide a free service of petrol-driven cars outside the building to convey visitors to the entrance which best suits their convenience. The improvements and extensions, which have cost about £30,000 each year, have made it possible to arrange the stands in symmetrical lines throughout the length and breadth of the Fair. Parallel avenues a third of a mile long stretch from one end of the building to the other, and they are intersected by similar avenues across the building. A simple system of numbering and lettering has been adopted, and illuminated overhead signs visible from some distance indicate the positions of the stands.

The improvements this year include a new block comprising a reception and luncheon hall (the "Bradford Room"), a public restaurant seating 2,000, a buffet bar and a smoke room; and a new conference hall, adjacent to the main building, seating 280 for lunch and 350 for conferences.

On Friday next week (as we have already reported) the latter hall will be the scene of a large electrical conference convened by the South-Midland Area Committee of the British Electrical Development Association. As it is one of the official visiting days of a number of electrical associations and institutions, there should be a large and representative attendance, and a useful discussion should follow upon Lt-Col. Vignoles's address on "How to Increase the Sales of Electricity and Electrical Apparatus."

The Electrical Section at Birmingham is now the second largest (the Hardware Section leading), with a floor space of 55,000 sq. ft. In this Section and in other parts of the Fair there are about 150 exhibitors of electrical machinery, appliances and equipment, or of goods of direct interest to the electrical industries

Mr. T. R. Martin (J. H. Tucker & Co., Ltd.), a member of the Fair Management Committee and an ex-chairman, has placed before us a number of notes on points that the industry might, in his opinion, be well advised to have in mind. For instance, seeing that the Fair has now thoroughly justified the belief of its organisers that an annual co-operative display of British products is a powerful instrument for use in expanding both overseas and home trade, he suggests that during the run manufacturers, and their Associations and Federations in particular, should carefully consider the whole question of the Fair in all its bearings and formulate plans with regard to the future. He has in mind, for example, what happens at Leipzig Fair, where the principal German industries, such as the electrical and the machine tool trades, have each erected their own permanent building, which is used each year exclusively for their own special displays. Whatever the views of the trade may be with regard to later years, however, and it may happen that ultimately different arrangements from those now in force will be introduced, the chief occupation of the industry from February 18th to March 1st will be in making this particular event as big a success as possible.

It will be remembered that the Castle Bromwich end of the Fair has been organised, and most enterprisingly developed, by the Birmingham Chamber of Commerce. Mr. G. N. Guest is chairman of the General Committee, and Mr. Chas. Stanley is the general manager of the Fair.

The Advisory Committee of the Electrical Section consists of the following:—

Mr. H. H. Berry (chairman); Mr. T. R. Martin (deputy chairman); the presidents of the Institution of Electrical Engineers, the Association of Mining Electrical Engineers, the British Electrical Development Association, the I.M.E.A., the Electrical Wholesalers' Federation, and the Electrical Contractors' Association; the directors of the Cable Makers' Association, the B.E.A.M.A., the E.L.M.A., and the B.E.D.A.; the chairman of council of the B.E.A.M.A. and the chairman of its Heating and Cooking Section; a representative of the Electrical Porcelain Manufacturers' Association, Dr. A. H. Railing, Mr. R. A. Chattock, city electrical engineer of Birmingham, and Mr. E. J. Jennings who once more fills everybody with gratitude for his painstaking efforts as honorary secretary.

As on previous occasions the opening of the Fair will be celebrated by a brilliant function at the Mansion House in London. The Government has invited a large company of distinguished colonial and foreign diplomats and representatives of our industrial and trading community to a banquet which will take place on Monday evening next, February 18th. Sir Philip Cunliffe-Lister, the President of the Board of Trade, will receive the guests and will preside. The Prince of Wales will deliver a speech demonstrating once more his own interest and that of the Royal Household in the encouragement of British trade overseas. The Prime Minister will also be present and the proceedings are to be broadcast.

At the White City the Department of Overseas Trade has a special inquiry office where visitors will be able to obtain practically any information that they may be in search of respecting British trade. Interpreters are in attendance whose services are available free of charge. As already stated, the Trade and Technical Journals also have a bureau of information where services will be gladly rendered, and the Overseas Club will also furnish facilities for the comfort and convenience of those who desire them.

Trade readers of this REVIEW who are visiting either London or Birmingham can avail themselves of the special railway facilities that have been arranged.

With these introductory notes we proceed at once with the first section of our descriptive notes of the electrical and allied exhibits at Castle Bromwich.

Some of the Exhibits.

A First Instalment of Illustrated Notes.

General Electric Co., Ltd.

A comprehensive selection of the company's products is on view. A special feature is a range of the products of the new "Magnet" Works, Birmingham. On the domestic heating side there is exhibited the new range of "Cosy-Glow" electric fires. In these the maximum radiant heat is obtained from two panel elements mounted at the front, supplemented by a Robertson flame-colour lamp behind, the glow from this being reflected by a hammered copper reflector. Another novelty is the "Magnet" self-protective electric kettle. A safety device incorporated in this takes the form of a fusible link which causes the electrical circuit to be broken as soon as the temperature exceeds that required for boiling purposes, and is easily replaced. A new electric wash-boiler is also shown. Other exhibits include the "Magnet" electric cleaner, an electric gramophone motor, and a complete array of kettles, saucepans, hot plates, &c.

The same works is represented by a new range of domestic electric cookers of which the new "Magnet" pressed steel cooker is of particular interest in that it is suited both for use in this country and for export. It is produced with an amply proportioned oven, grill, hot cupboard and three hot-plates. The oven is placed at a convenient height from the floor. In addition to this the variety of other models shown renders it possible to satisfy all requirements. A display of electric grillers and boiling plates completes a very comprehensive range.

In the industrial heating section two electric furnaces are exhibited. The smaller, an 8-kW furnace (fig. 1), is capable of operation up to a maximum temperature of 1,750 deg. F. The sheel is of steel plate reinforced with angles, while the door, which is of cast iron filled with refractory heat insulating bricks, is operated by balanced mechanism controlled by a hand lever. The muffle is of refractory fireclay, and is wound with high grade nickel chrome wire, arranged to give an even temperature throughout the length of the muffle. This is backed by insulating bricks and finally with special magnesia-asbestos slabs. Automatic temperature control equipment is provided. The 30-kW furnace shown is similar in many respects, but incorporates additional refinements and mechanism necessary for the greater load. A "Magnet" electric japanning oven is also on view. Heavy articles to be enamelled are loaded on trucks and run into the oven, which is sunk to rail level. Doors are provided at both ends to facilitate loading and unloading. The heating elements are entirely encased in steel tubes, and are thus protected from all fumes, while automatic temperature control is provided.

Electrical apparatus for the production of distilled water is to be seen in the form of the "Magnet" electric water still

Fig. 1.—A "Magnet" 8-kW Muffle Furnace.

(fig. 2), which is loaded at 4 kW. This still is arranged to deliver one gallon of distilled water per hour. The water is boiled in the lower part of the vessel, and the lid takes the form of an inverted cone inside which cold water is permitted to flow. The steam from the boiled water condenses on the under side of the cone, from which it drifts into a delivery pipe. "Magnet" electric water heaters of 2½, 10 and 20-gal. capacity are shown, the 10-gal. size being in actual operation. Further interesting exhibits include a conforming steamer for hats, in which the felt is steamed for the purpose of shaping, electric glue pots and soldering irons. Electric lighting supplies and fittings are also products of the new "Magnet" works, and the former are represented by a six-sided kiosk. Some fine examples of modern ornamental G.E.C. fittings, industrial reflectors, and "Wembley" lanterns are suspended from the facia board of the stand, while a new range of lighting pendants fitted with "Bakelite" galleries, lampholders and ceiling roses is shown.

A separate section of the stand is devoted to "Osram"

Fig. 2.—A "Magnet" Water Still.

lamps and valves, including the "Pearl" type, colour-sprayed lamps, and projector and "Strip-lite" lamps. A feature of interest is a historical display of "Osram" showcards, going back roughly 20 years. "Osram" valves of all types are shown in this section, from the latest range of receiving valves to large transmitting water-cooled anode valves. The "Osram Music Magnet," a receiver for home construction, is also being exhibited.

The G.E.C. telephone works are represented by a display of bells and accessories, among which is the new "Bakelite" bell. Radio receiving apparatus is another important product of the same factory; the new "Gecophone" "Portable Screen Grid 4" receiver is being shown, together with the "World Wide Screen Grid 4."

The Pirelli-General Cable Works, Ltd., is represented by a large cable drum on which are mounted samples of the company's products.

A large replica of an electro-magnet, the well-known G.E.C. trade mark, made up of conduit, attracts the eye to the "Magnet" conduit display, in which a complete range of conduit and conduit accessories is shown. The Witton display consists of an old Byng-Hawkins motor which has been in continuous use since 1898, surrounded by eight new standard "Witton" motors of the drip-proof squirrel-cage and d.c. shunt-wound protected types. The squarrel-cage motors are for general industrial purposes, and are suitable for all cases where protected or enclosed ventilated machines are required. All the machines comply with British Standard Specification. The louvre covers over the commutator openings offer an unusual degree of protection, and the impregnation of the windings is such that the motors are capable of withstanding tropical conditions.

Examples of ironclad switchgear are shown, including the dwarf circuit-breaker suitable for use in controlling small domestic appliances, cookers, testing and changing circuits, &c.; counter-e.m.f. starters for d.c. motors (push button or pilot switch control); and a 5-amp. flame-proof S.P. quick-make-and-break switch for use in situations where petrol vapour or other inflammable gases are present. A triple-pole 50-A quick-make-and-break switch with fuses is also shown; this complies with Home Office regulations.

Berkeley & Young, Ltd.

The principal feature of this exhibit is a complete range of electric fans for all purposes, for both a.c. and d.c. These include table and bracket types, suitable for general domestic use, offices, shop windows, bedrooms, or in any position where a moderate breeze is required; the "Ellipso" fan, which has an oscillating motion; the slow-speed ceiling fan, suitable for use in kinemas, restaurants, dance halls, &c., or for tropical climates; exhaust or box blade fans for kinemas and other public buildings; and porthole exhaust fans, suitable for ventilating small rooms, warehouses, lavatories, kitchens, &c. Another exhibit is the "Giljay" battery charger, a very compact little set for operation from the mains. It is made in three sizes, 4 A, 9 V; 5 A, 15 V; and 8 A, 30 V. A little switchboard mounted on the frame of the generator bears an ammeter and resistance.

George Ellison, Ltd.

On this stand there is shown a range of switchgear and accessories for the control of electrically-driven machinery for all industries, and sub-station switchgear for up to 11,000 V pressure. Ellison switchgear is also employed in the Fair sub-station controlling the h.p. supply from the Corporation mains to the transformers, and from the transformers to the various circuits. The exhibits include resistance starters and control panels for slip-ring induction motors; direct-on, star-delta and auto-transformer starters for squirrel-cage motors, automatic circuit breakers of various types; underground switchgear and cable couplings for mines; control equipment for cranes; and several examples of metal-clad distribution and main switchboards. A new design shown is an improved totally-enclosed circuit breaker for power circuits up to 660 V, having an unusually high breaking capacity on short circuits, and accessory fittings, which make the work of installing and connecting up very easy. This gear (fig. 3) can be operated

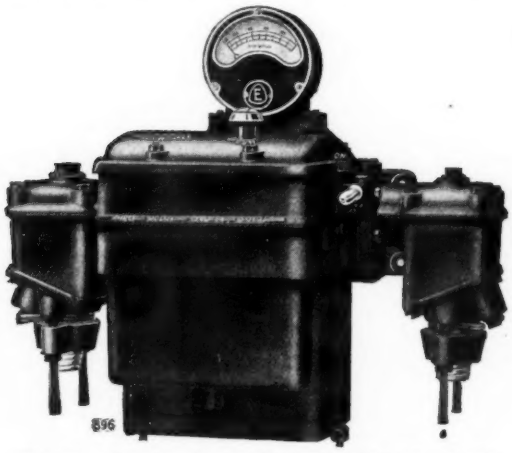


Fig. 3.—A New 660-V Totally-enclosed Circuit Breaker.

with safety by workmen without special knowledge. A new type of switchboard exhibited consists of a group of small automatic circuit breakers mounted up on a busbar enclosure to form a distribution point for branch circuits. This is an alternative to switch-fuse gear, and it is only necessary to move a handle to re-close a circuit. A circuit breaker for use at the coal face in mines, mounted on skids for portability, is another exhibit. It is a welded-steel cased flame-proof unit, fitted with trailing cable plug connector and end coupling for the supply cable. The cable end coupling is a patented accessory which obviates the jointing of cables underground, as when the breaker is moved and another length of cable has to be laid, the new length of cable is readily connected up by bolting together the sealed-end boxes, and connecting the cores by the links provided. The high-pressure switchgear, of which typical units are shown, comprises draw-out, drop-down, truck-type and fixed cubicle metal-clad units all of standardised manufacture. All this switchgear is designed with good spacing of the live parts and made easy of access for maintenance. The sheet-steel enclosures are rigidly bolted and welded in jigs, and units of similar design are therefore interchangeable. In addition to the switchgear, there is a display of insulating material which is made in the Ellison factory for use in switchgear. It includes "Tufnol" in all kinds of shapes and as a plastic compound. This is a laminated synthetic resin material baked under pressure in moulds and is extremely tough, with high dielectric quality.

Electric Furnace Co., Ltd.

This company exhibits plant and photographs illustrating the various types of electric furnace which it installs. These installations comprise furnaces of various types for melting and heat treating all kinds of metals, the standard types of furnaces including the "Héroult" arc furnace for melting steel and nickel; the "Ajax-Wyatt" induction furnace for melting brass and nickel-silver; the "Ajax-Northrup" high-frequency furnace for melting steel and non-ferrous alloys; resistance furnaces of the "Efco," "Efco-Doulton" and "Wild-Barfield" types for heat treatment of steel and non-ferrous alloys, for core drying and enamelling, &c.; the "Snead" equipment for heat treating tubes; furnaces for the manufacture of calcium carbide and ferro-alloys; and amorphous and graphite electrode plants. Most of these furnaces are too large to be shown in operation in an exhibition. The working furnaces accordingly consist only of a small "Ajax-Northrup" high-frequency furnace and an air heater. The former illustrates the principle of high-frequency inductive heating, and is itself a unit suitable for laboratory work or for melting platinum or other precious metals. The body of a one-ton "Ajax-Northrup" furnace is also shown, the furnace being identical with one now being erected in France. This furnace is claimed to be four times as large as any plant yet in operation, and the whole of the plant has been designed and manufactured in Great Britain.

A metal liner, as used in the "Efco" process of formed linings, suitable for use in this furnace, is also shown. A number of electric furnace products are displayed to demonstrate the wide range of electric melting and heating. These include an exhibit by Messrs. Doultons, Ltd., of pottery decorated in a 115-ft. double-chamber "Efco-Doulton" kiln; samples of high-speed steel made in an "Ajax-Northrup" furnace in Sheffield; various articles made of "Silveroid" and other products of high-frequency furnaces; and samples of electrodes, ferro-alloys, &c.

J. H. Tucker & Co., Ltd.

This company's stand is in approximately the same position as it has occupied in past Fairs. The exhibits consist of examples of the company's extensive range of general wiring accessories, including lampholders, ceiling roses and porcelain ware, tumbler switches, ironclad fusegear and switchgear, and switchboards. Special prominence is given to lines which have been introduced since the last Fair. These include a new range of combined switches and sockets, which have been specially designed to eliminate erection difficulties, especially in sunk boxes. The unit consists of a single base of porcelain with corner feet with the switch and the socket mounted thereon. The fixing of the whole unit in either iron or teak boxes is accomplished by two screws, and does away with any form of mounting brackets. In the surface pattern of this range, the unit is entirely enclosed in a "Bakelite" case secured to the case by a single screw. Other new lines are an interlocked heavy-duty switch-plug, "Bakelite" lampholders (both of the ordinary and Home Office types), and similar lampholders incorporating a quick-make and quick-break switch action with push-bar operation. The miniature 5/15-A range of H.O. fuseboards which made their first appearance at last year's Fair in teak cases, are now shown for the first time in iron cases. Special wiring facilities have been incorporated in this new range, including detachable end plates for drilling. An entirely new range of ironclad switches and switch-fuses with quick-make and quick-break action in double-, triple- and four-pole types, makes its appearance. Single- and double-pole service cut-outs incorporating a fuse unit of new design are also exhibited; these are designed to meet I.E.E. Regulations and B.E.S.A. short-circuiting requirements. Another special feature will be the exhibition for the first time of the complete range of 3-pin sockets and plugs made to B.S.S. No. 317, which was issued late last year. This range will consist of the 2-A, 5-A and 15-A sizes in surface, floor and switch plate mounting types.

Messrs. Tucker also show their standard products, such as complete switchboards for country-house lighting, knife switches and fuses up to 1,000 A, &c.

A novelty is provided in the form of a demonstration mechanically operated on the endless-belt system, by which it is hoped to bring home forcibly to customers the very extensive nature of "Tucker" products. A generous amount of space is devoted to products in "Telacite" and "Bakelite."

Taylor & Challen, Ltd.

These manufacturers of production machinery are showing some of their double and single action presses. A new machine which is on view is a high-speed notching press. This will deal with disks from 3½ in. to 17 in. in diameter, and will punch the notches at rates up to 620 per minute.

British Thomson-Houston Co, Ltd.

The exhibits of this company cover a wide field of electrical applications, and many of them are shown in operation. They include electric motors and control gear for industrial use; in addition to a.c. and d.c. motors of the standard types, the company shows single-phase reversing motors of the repulsion-induction type; vertical spindle motors; "built in" motors for the direct drive of machine tool cutters; motor-generators; "Fabroil" silent pinions, &c. B.T.H. single-phase repulsion-induction motors are designed to start up as repulsion motors, and when up to speed to run as induction motors, there being an external or primary winding on the rotor which gives a high starting torque, and an internal or squirrel-cage winding which allows only a very small speed variation from "no-load" to "full-load." They have very satisfactory starting, accelerating and running characteristics, and also a high efficiency and power factor. They require simple starting gear, and are particularly suitable for duties where high starting torque and good acceleration are required, as, for example, on lifts. Suitable equipments for the control of a.c. and d.c. reversing and non-reversing motors of various sizes are shown, these being of both the wall mounting type and pillar type. Included in these is the new B.T.H. thermal type oil-immersed circuit breaker and a.c. motor starter (fig. 4) which has been designed primarily for the direct starting of squirrel-cage motors taking up to 100 A starting current on voltages up to 660, and giving full protection against every kind of fault on all phases. This breaker is only 8⅝ in. high, 7⅝ in. deep, and 6 in. wide, has a dust-and drip-proof enclosure, and is under push-button control, either local or remote.

Thermal overload protection on each phase is provided, and it has an instantaneous short-circuit trip and low voltage release. The high momentary starting currents taken by squirrel-cage motors when started by direct connection to the mains are safely carried without the breaker tripping, but no overload can persist for a sufficient time to cause injury to the motor insulation by overheating.

Among the gear shown for the first time is the new B.T.H. metal-clad vertical plugging switchgear, known as "Class Z" (fig. 5). This switchgear is suitable for service under the most adverse climatic and other conditions, and its introduction makes the metal-clad construction commercially applicable to small circuits. Moreover, the utmost economy is achieved in the use of space and material. The busbars are completely shut off from other chambers, but they can conveniently be rendered accessible. An automatically operated shutter closes the contact socket holes when the breaker is withdrawn, and guide holes are provided for accommodating locating spears carried by the oil circuit breaker, so that it can be lifted into place in correct alignment; circuit breaker units are interchangeable in all respects, and are vermin-proof, and only one simple lifting carriage is required for a complete switchboard. The contacts are of a special self-aligning type, and the current transformers are housed in the circuit breaker top casing, and are readily accessible and interchangeable. Contact is made with the circuit connections below, through the medium of spring pins carried on porcelain insulators in the bottom of the transformer tank. Withdrawal of the fuses through the top isolates the voltage transformer in complete safety. The pedestals do not require precision alignment, and a full system of automatic interlocks prevents inadvertent mishandling. The example illustrated is for 600 A at 11,000 V.

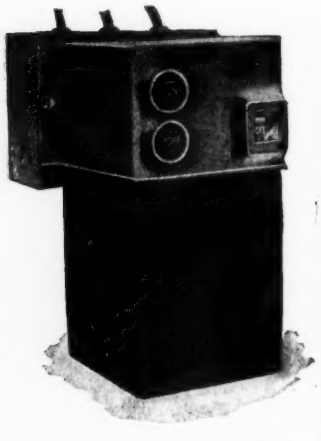


Fig. 4.—A B.T.H. Circuit Breaker and Starter.

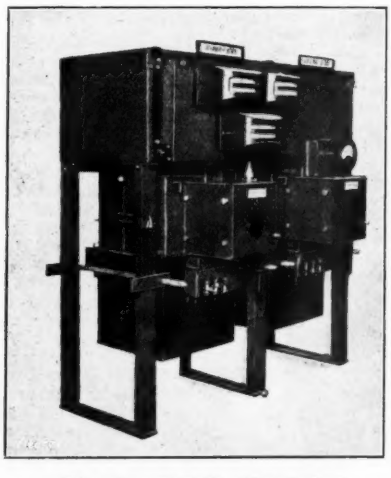


Fig. 5.—B.T.H. Metal-clad Plugging Switchgear.

A section of the stand is devoted to a display of B.T.H. radio apparatus and "Mazda" valves; and an electric gramophone motor, and pick-up, working in conjunction with an "R.K." loud speaker, demonstrate remarkable purity of tone and faithful reproduction of the original. The motor is of the universal type, and operates on any lighting supply from 50 to 250 volts d.c. and 100 to 250 volts a.c., 25 to 60 cycles through an adjustable graduated resistance (for 60 to 100-cycle circuits another model is available). It is absolutely silent (operating at 320 revs. per minute), and drives the turntable through a woven belt which is practically indestructible. Belt slip is prevented, and stretch is compensated by a spring tension device, while constant speed is maintained by a governor of the same design as used on spring motors. A switch automatically stops the motor when a record is finished. In this section also is a display of "Tungar" battery charging equipments and the "Tungar" trickle charger.

Special prominence is given to fittings for industrial purposes, and the scientific use of coloured lighting is demonstrated. A tableau depicting a dancing girl on a draped stage is illuminated by continually changing coloured light, a motor-driven control apparatus being employed. The industrial lighting equipment shown includes fittings suitable for such purposes as street, shop, drawing office and public building lighting. Electric signs are another exhibit.

Metro-Vick Supplies, Ltd.

This stand has been divided into separate compartments, an arrangement lending itself to a more effective display of the various types of apparatus. The front of the stand is devoted to "Met-Vick" electric cookers. Two types are shown, a large size with either two or three boiling plates, and a small model with either one or two boiling plates. Demonstrations of cooking on both models are being given daily. "Met-Vick" extra-rapid boiling plates fitted to table stands are also included in this section, together with this type of plate suitable for fitting to other makes of cookers. There is also a comprehensive range of irons, jugs, urns, &c., the chief item of interest being the "Met-Vick" automatic kettle in 2-, 3-, and 4-pint sizes. This automatic kettle was introduced last June, and since then more than 200 supply authorities have standardised it. For the first time is shown the company's new self-regulating automatic safety kettle. This not only automatically cuts off the current before the kettle can boil dry, but also cuts down the current just enough to bring the water gently to the boil, and maintain it there, thus preventing splutter or overflow from the lid or spout. In addition, the "spring-clear" device is incorporated to prevent damage if accidentally switched on when dry.

Demonstrations are also being given with the "Met-Vick" gyratory washing machine; the large model will wash eight full-size sheets or equivalent, and the small model six full-size sheets or equivalent. Another portion of the stand is devoted to water-heating appliances. The Model "A" wash boiler is being demonstrated. The outer casing and lid are made from steel, blue enamelled, the interior container being stout gauge copper, tinned inside, all being mounted on three cast-iron feet; a tinned-copper spraying device can be supplied to order. Various types of storage water heating and electric geysers are also available for demonstration purposes.

A complete range of fires is shown, including pedestal fires, radiant fires, utility (flat bar) fires in 1- 2- and 3-kW sizes, and various styles and finishes. The latest addition is the "Met-Vick" 3-kW imitation coal fire finished in chromium plate (fig. 6). The company's radio apparatus is also included in the exhibit. This comprises various styles of the "Met-Vick" five-valve set for mains operation, employing "Met-Vick" a.c. valves and eliminators. There are three- and four-valve "A.N.P." sets, complete with a.c. valves, for operation from the mains. For use with these sets a new combined eliminator for l.t., h.t. and grid bias is now available.

The display of wiring accessories includes lampholders and switches in various finishes. The latest additions to this range are shockproof switches, "Bakelite" ceiling roses and lampholders.

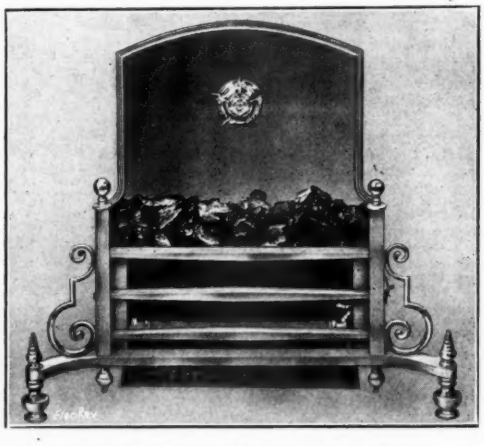


Fig. 6.—A New "Metro-Vick" Fire.

Fig. 7.—An example of "Gilbert Riley" Glassware.

Colour lighting is employed for floodlighting of the interior of the stand, this being carried out by means of "Cosmos" pearl lamps with "Met-Vick" ray reflectors and colour screens. A varied selection of standards, brackets, electroliers, &c., have been installed for the general demonstrations of the stand. On the pillars and partitions more than thirty different types of panel wall brackets have been installed with electroliers to match. Several of these incorporate the new "Gilbert Riley" glassware, an example of which is illustrated in fig. 7.

G. D. Peters & Co., Ltd.

This exhibit consists of two sections, as follows: Wilson "Plastic Arc" electric welding plants and "Colour-Tipt" welding metals; and "Graphol"—rust solvent and penetrating lubricant. The welding section includes a 2-arc stationary motor-generator type welding plant and a single-arc portable motor-generator type set, both of them fitted with Wilson "K.5" automatic current control panels. By means of the latter the current can be regulated to within 5 per cent. The effect of this is that the heat in the weld is kept localised and constant, and it is possible to weld large iron castings without preheating. In this way heavy machines can be repaired without the necessity of being dismantled. The low voltage (18 V at the arc) obviates the use of expensive fluxed or slag covered electrodes. The two-operator stationary welding plant consists of a suitable motor connected through a flexible coupling to an open bracket type level-compounded generator, having a capacity of 300 A at 37-45 V, the variation in voltage being controlled by shunt field regulation. The set complete with motor starter is mounted upon a substantial baseplate, complete with automatic current control panels, and the plant is complete with the usual welding accessories. The single-arc set consists of a suitable motor direct-coupled to an open bracket type welding generator having a capacity of 150 A at 37-45 V. This is mounted together with an automatic current control panel, motor starter, and shunt field regulator on a substantial channel baseplate, being complete with welding equipment. This set is in operation, and trial welds are made for interested visitors. A large quantity of "Colour-Tipt" welding metals is on view.

Chloride Electrical Storage Co., Ltd.

On this stand there is a selection of different types of "Chloride" batteries for house lighting, both open and fully-charged sealed-in cell, adopted as the standard design by the chief lighting set manufacturers in this country. These cells range from 20 to 180 Ah capacity. A special feature is the new patent emergency lighting system ("Keepalite"). This has been specially designed for operating theatres of hospitals and institutions where it is absolutely essential that the light shall not fail for an instant. It consists of emergency lights which can be supplied for approximately one hour from a battery which is controlled by an automatic switch. The change over is entirely automatic, and when the main supply resumes the auxiliary lighting is cut off. The batteries on exhibition include specially designed types for radio work, including the latest developments in high-tension batteries. Among them is the new "WT" 10-V battery with a specially large capacity of 10,000 milliampere-hours for kinemas, public address systems and other high-power work. This consists of a moulded multi-compartment 10-V glass unit. A 30-V assembly in crate with carrying handle is also shown. The "WH" 10-V h.t. unit (5,000 milliampere-hours) supplied in assemblies of 40 and 60 V, is again exhibited. The usual range of l.t. batteries in celluloid boxes is on view, together with cells in glass boxes. A new range of patent unspillable batteries in celluloid boxes for portable wireless sets and h.t. and l.t. batteries suitable for medical purposes are also exhibited. Other batteries shown include types for marine wireless installations, lifeboat sets, gyro compass operation, traction, train-lighting and mining purposes.

Cable Makers' Association.

This exhibit has been prepared to illustrate the various types of cable used for power and lighting purposes, as also some of the more ordinary types of underground telephone cable. It includes rubber insulated cables; flexible cables, with external braiding, flexible armouring, spiral wire armourings, &c.; ship wiring cables; main cables, showing the methods of insulating underground cables with paper, cambric, bitumen or rubber insulations, and exemplifying various styles of armouring and protection; telephone cables; under-water power cables; house wiring systems, including rubber-insulated braided cables run in special conduit tubing; metal-sheathed cables for surface wiring, and fittings for use with them, &c.

Bull Motors, Ltd.

This company again exhibits a comprehensive range of electrical machinery. In addition to the examples of standard d.c. and a.c. motors, some of which are shown in motion, there are a number of interesting exhibits of special machines recently constructed. The h.p. motor generator set, for ships' wireless, is again shown. Since the last Fair a substantial repeat order has been received for these sets. The set is shown in operation with the h.p. end delivering 1 kW at 2,400 V d.c., the output being utilised for illuminating a sign. Another exhibit of interest is a special motor-driven high-frequency alternator, typical of a number which have been supplied to the British Post Office and leading wireless telegraph companies. The alternator delivers a single-phase output of 2 kVA at 450 cycles. A motor-generator set, consisting of a standard squirrel-cage induction motor direct coupled to a standard shunt-wound generator, is shown in operation supplying energy at 500 V to a special series-wound motor direct coupled to a tramway brake compressor. The series wound machine is specially constructed for building into one unit with the compressor. About 540 of these machines have been, and are being, supplied to a leading tramway undertaking. An example of the "Bull" trolley 'bus motor is again exhibited. A special exhibit demonstrating the components and the method of construction of "Bull" induction motors is of interest. A section through the slot shows the high standard of insulation, and demonstrates the efficacy of vacuum impregnation in efficiently filling the slot spaces with insulating varnish.

George Bray & Co., Ltd.

"Chromalox" heating units and examples of their application are exhibited by this company. This form of heater consists of nickel-chromium ribbon or coil embedded in a refractory material under hydraulic pressure, the whole being then enclosed in a sheathing of rustless iron, nickel-chromium or Monel metal. The units are very strong and moisture proof; the terminals are fitted in a special manner. The

Fig. 8.—A "Chromalox" Urn Heater.

simplest application is space heating, the standard sizes being 12 in. and 24 in., with loadings of 220 W and 500 W, respectively. For boiling purposes ring units are available, with loadings of from 660 W to 1,750 W, the diameters rising from 6¼ in. to 9½ in. The units are also made up as radiators with metal cases. Another application is immersion heating, a very wide range of sizes and loadings being available. Our illustration (fig. 8) depicts a ring-type urn heater with a three-heat snap switch.

Donovan & Co.

As in previous years, this firm has a comprehensive display of ironclad switch- and fuse-gear for medium pressures to comply strictly with Home Office regulations, d.c. motor starters, shunt regulators, fan regulators for the tropics, dimming switches, interlocked-switch wall sockets and plugs, cable connectors and spider boxes for use in kinematograph studios, ironclad switchboards, open-type switchboards, &c.

Siluminite Insulator Co., Ltd.

Two specialities are given prominence by this company. One is a new grade of "Siluminite" panels suitable for switchboards. This is made in fireproof material with a stove-enamel finish on the surface and is said to be the nearest artificial substitute for slate. It is of good dielectric strength and stronger than slate and has been specially made to comply with the regulations of various electricity authorities in the colonies. The other novelty is a special grade of fireproof material of high mechanical strength for fuse handles. This material is of high dielectric strength, non-absorbent, and will withstand considerable arcing without carbonisation. It is baked out up to 450 deg. F. during the process of manufacture. Samples of this material are shown in well-known makes of fuse handles, which the company is now manufacturing, for example, 60-A and 200-A "Fluvent" fuse handles and 250- and 500-A fuse handles for Messrs. G. P. Dennis, Liverpool. In addition to the foregoing there are numerous boxes in moulded materials for combined switch and fuse boxes, electric railway couplings and track insulators, including one as supplied to the G.P.O. electric railway, all of which are in a fireproof grade of material. The company is also showing a large range of overhead telegraph and telephone insulators in its "Ebbinita Grade 2," and a new design of dummy insulator for use as a bird guard on overhead lines.

A. Reyrolle & Co., Ltd.

Owing to limitations of space, Messrs. Reyrolle are unable to show any of their larger standard gear, but have staged a model built to ¼-scale, and showing all the essential features (fig. 9). The model can be taken apart, and sectional diagrams attached to the dividing planes give an excellent picture of details. Switchgear of this type is in successful use for voltages up to 50,000, and is built in sizes up to 1,500,000-kVA breaking capacity. All the conductors, including the busbars,

are adequately insulated and completely enclosed in earthed metal enclosures, and the spaces between them and the inside walls of the enclosures are filled with solid insulating compound. The switchgear is made up in self-contained units capable of being built together into complete switchboards, and interlocks are provided to make a wrong sequence of operation impossible. Generally, the construction is such as to prevent anyone from touching a live conductor accidentally, or from coming within arcing distance of it. Each unit comprises a fixed portion, which incorporates the busbars, the instrument transformers, the cable dividing boxes, and the supporting framework; and the removable portion, which includes the oil-immersed circuit-breaker and the necessary operating mechanism. The removable portion is capable of being racked out from the fixed portion so as to facilitate inspection of the circuit-breaker, and the connection between the two portions is by means of a plug and socket arrangement, which automatically isolates the circuit-breakers from the live parts of the circuit when it is withdrawn. The interlocking devices make it impossible to plug the removable portion in when the main circuit-breaker contacts are in the closed position; to close the switch when the removable portion is not fully plugged in; to withdraw the removable portion when the main circuit-breaker contacts are in the closed position; or to remove the oil tank before the removable portion is withdrawn. The circuit-breaker cannot be closed until the lock is secure, and, once closed, the lock cannot be released until the circuit-breaker is re-opened.

The company also shows examples of its metal-clad control boards for connecting and controlling the supply of current to electric cookers for pressures up to 250 V. Operation is simple, and provision is made for earthing the casing and interlocking the switch with the lid. On the standard design (fig. 10) the main supply to the cooker is controlled by a double-pole, double-break, 30-A quick-make-and-break switch, fitted with terminals for taking the incoming and outgoing cables either at the top or at the bottom of the box. The fixed contacts of the switch are fitted with self-aligning clips, and they are adequately shielded and protected by means of porcelain caps, which prevent the possibility of sparking. An auxiliary circuit is provided, coupled to the socket of a 5-A or 15-A British Standard plug and socket of the protected type. This circuit is for a kettle, hot plate or other appliance. A small indicating lamp is mounted behind a red bull's eye on the lid to show when the 30-A switch is closed. Another design is shown containing a change-over switch suitable for controlling, in addition, a water-heating circuit which contains a thermal device to disconnect the supply when the water has reached a pre-determined temperature.

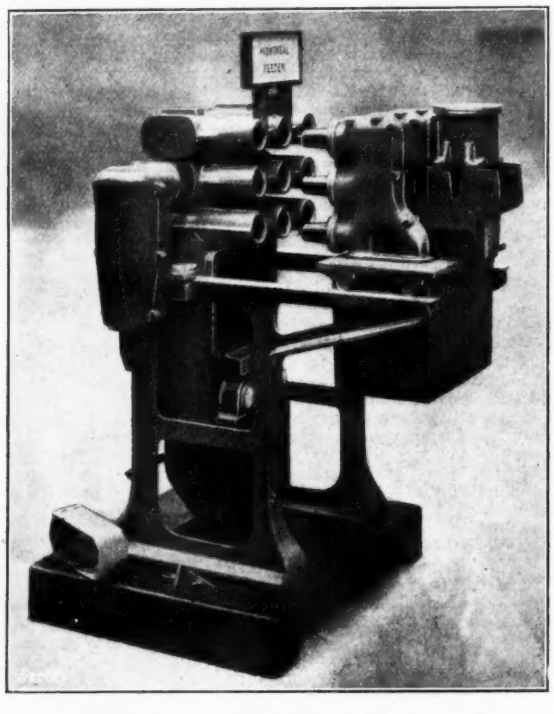


Fig. 9.—Model of a " Reyrolle " Duplicate Bus-bar Unit.

The company shows heavy-duty plugs and sockets for industrial use rated at 100 A and 250 A at 660 V. An example of the smaller size is shown combined with a 100-A switch; the larger size can also be combined with a switch, and both may have fuses added if required. The combined switch and plug equipment comprises three main parts: a cable dividing box, a 100-A brush contact air-break switch, and a 100-A plug and socket. The switch and plug are mechanically interlocked, and the lid of the switch-box is also interlocked with the operating mechanism. Earthing facilities are provided right through to the plant controlled, and the whole construction is water-tight.

Another exhibit is an immersion-type water boiler. The sample shown is of 18-kW capacity, and is capable of raising steam in from 10 to 15 minutes. The steam pressure is 80 lb. per sq. inch, and the boiler evaporates 40 lb. of water per hour. The heating elements are built up of three 6-kW units,

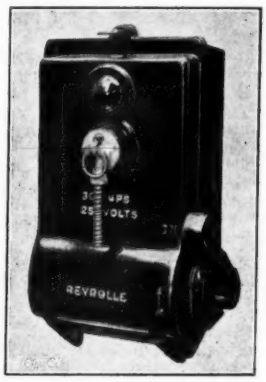


Fig. 10.—A " Reyrolle " Cooker Control Board.

and the required selection is made by means of a standard " Reyrolle " earthed plug. Three sockets are provided, so arranged that either one, two or three are in circuit. The c.t.s. cable, which is employed, is provided with a third core to form part of the definite and continuous earth circuit from the boiler to the earthing terminal of the outlet plug. The fittings are nickel-plated, and the boiler is attractively finished in white enamel.

R. A. Lister & Co., Ltd.

In this exhibit there is a section of particular interest to those concerned with the problem of supplying current for the lighting of country houses and estates, farms, churches, and other buildings which are in districts not reached by power lines. Three " Lister " electric lighting plants are exhibited, and they represent the range of " Lister " plants which can be obtained in various capacities to suit every purpose and pocket. They comprise a 1-kW and a 1½-kW plant, both for battery charging, and a 1½-kW " Lister-Bruston " fully-automatic plant. The power for all " Lister " electric lighting plants is supplied by 4-stroke, slow-speed, vertical, water-cooled engines. These engines vary for different sized plants, but they are all of totally-enclosed design, making them dust, dirt, and grit proof, and are automatically lubricated—oiling is effected from a single oil reservoir in the crankcase which is of ample capacity to run the engine for several months without attention. The sensitive throttle governor employed controls the engine speed to within very fine limits, and most engines include the " Ricardo " detachable combustion head. Five types of such engines, apart from the lighting plant section, are exhibited on Messrs. Lister's stand. The generators are of open protected construction, shunt wound for battery charging, and are capable of developing their full output at the minimum and maximum voltages without overheating. The dynamos are of the 4-pole type fan ventilated, and are fitted with ball-bearings. They are designed with a starting winding enabling the engine to be started electrically with the minimum expenditure of electrical energy. The sets are equipped with switchboards, on which are mounted the necessary instruments, and switchgear. These can either be mounted direct on the plant making it a complete unit, or can be separate for wall mounting. The plants are shown in operation.

Restlight, Ltd.

Various models of lighting units of the " Restlight " system, including a special filter, for eliminating glare and preventing eyestrain, are to be seen on this company's stand. The system owes its inception to Mr. F. E. Lamplough, M.A., and is in use in all types of business houses, factories, schools, libraries, laboratories, hospitals, picture galleries, &c., especially in nurseries and studies. The light given by " Restlight " units resembles mild diffused sunlight. A slight amount of " red " is permitted to pass through the filter to compensate for the coldness usually associated with artificial daylight. This factor has rendered the system of value in the lighting of picture galleries. The company claims that the use of the system in industry abolishes eyestrain, reduces errors in close work, and increases efficiency and output. Another exhibit is the Lamplough " Daylamp " for accurate colour determination, which is extensively used in the British textile and colour industries. The " Daylamp " is said to render a " colour " industry or one engaged in close laboratory analysis completely independent of climatic changes and artificial light.

Hewittic Electric Co., Ltd.

"Hewittic" mercury-arc rectifiers are installed in the Fair sub-station, to provide the necessary d.c. power from the 5,000-V, 25-cycle, three-phase Birmingham supply. The equipment is made up of two 92-kW sets, each comprising a step-down transformer, an induction regulator, a 200/0/200-A, 230/0/230-V rectifier unit (three-wire), and automatic pressure and load control. Operation is entirely automatic.

On the company's stand the following equipment is exhibited: A lift type rectifier, capacity 30 A at 440 V d.c., suitable for supplying a 15-h.p. motor. This rectifier enables standard

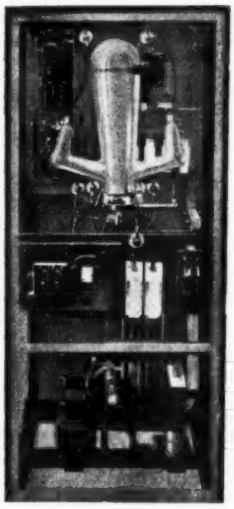


Fig. 11.—A "Hewittic" Lift Rectifier.

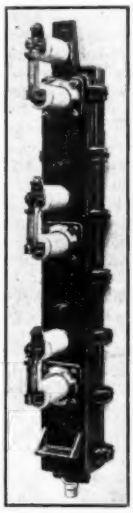


Fig. 12.—A "Callender" Link Isolating Unit.

lift gear to be used on an a.c. supply. The equipment is enclosed in a sheet-steel cubicle with wire mesh for ventilating purposes at the base. Fig. 11 is an interior view of the gear. A switch-fuse is provided where lifts are in fairly constant use, the arc being maintained. Where use is infrequent, an automatic a.c. clapper switch is fitted (as in the illustration), and the rectifier only functions when the lift is operated. An "I.T.6" rectifier, delivering 2-6 A at 6-75 V d.c., from any standard a.c. supply, is shown. The "I.T.M." rectifier which is displayed delivers 3.5 A at 220 V d.c., and is particularly used for feeding ultra-violet-ray lamps and other medical and dental apparatus, small motors, &c. An example of the largest single unit made by the company is on view. This has a capacity of 260 A at 550 V, or 300 A at 250 V.

The stand is illuminated by "Service Light" units, each of 1,200-candle power. Silica lamps as used for high buildings and yard lighting are also exhibited. The current consumption of these lamps is: Long tube type, ½ W per candle power; silica type, ¼ W per candle power. The company shows a single-tube studio stand and various types of tubes—rectangular, M-shaped, &c.—as used for printing, enlarging, &c. A special "Rhodamine" reflector is fitted behind the tube of the studio lamp outfit. This reflector is used wherever it is desirable to have the full spectrum with red rays, such as when using panchromatic films or plates.

Various types of ultra-violet-ray lamps—stand outfits, suspension outfits, &c.—are shown. One of the special features is the "Hewittic-Eidinow" burner, which is similar to the usual quartz burner, but is made of a different material, and cuts off the shorter and more active ultra-violet-rays, allowing, however, a very rich amount of ultra-violet-rays above 2,900 A to penetrate. The more violent rays, which require special application are screened off.

Hackbridge Electric Construction Co., Ltd.

The exhibits of this company, which shares the Hewittic stand, includes drawings and photographs of all types and sizes of transformers, and a number of coils are on view showing insulation and reinforcement for very high voltages. A pole mounting transformer of the company's manufacture, is also exhibited, and Hackbridge transformers are under load in the sub-station supplying the exhibition.

Callender's Cable & Construction Co., Ltd.

This company is showing a complete range of l.p., h.p. and e.h.p. cables, up to and including 66,000 V. The range covers paper, rubber and cambric insulated cables, lead sheathed, armoured, taped and braided; special cables for ship lighting and colliery work; patent rubber c.t.s. cables; "Ancalite" cables for railway signalling work, &c.; insulating tapes and compound, and jointing accessories; "Callender-Kay" poles and accessories for overhead transmission line work. There are also interesting specimens of outdoor type dividing boxes up to and including 66,000 V, indoor dividing boxes up to 11,000 V, and straight joint boxes to suit all voltages; transformer pillars showing standard C.S.W. l.p. fuse-gear, h.p. and l.p. switch pillars and network boxes, chill cast lead sleeves, all types of service boxes, pathway and roadway frames and covers, house-service fuse boxes (including a new standard insulated fuse box), various types of unit gear for pillars and sub-station switchboards, distribution boxes, cable hangers, and sealing ends up to 33,000 V. Fig. 12 illustrates one of the exhibits a l.p. three-phase isolating link unit for use in feeder pillars or sub-stations. Actual demonstrations are being given with the "Callender-Wilson" precision plumbing apparatus, of electrical and mechanical plumbing for fiery mines or for ordinary outdoor use. The company is also making a special exhibit of the "Kalibond" system of wiring.

C. H. Parsons, Ltd.

This company is one of the regular exhibitors at the Fair. As in previous years, the stand bears a comprehensive selection of well-made "Britmac" switches, lampholders, and many other accessories. There is an attractive display of "Bakelite" switchplates among other fittings in this material.

H. C. Slingsby.

On this stand there appears a selection of about 60 of the 1,900 designs of trucks, ladders, barrows, &c., made by this firm. Examples of electric trucks are included.

Crossley Bros., Ltd.

Two new examples of heavy-oil engines not previously shown at any exhibition are mounted on this stand. The first is a vertical 4-cylinder type, and the second a horizontal 2-cylinder type. Both are shown working on fuel oil.

Fig. 13 illustrates the vertical engine, which is a compressorless Diesel engine having a normal rating of 110 b.h.p. It is shown direct-coupled to a Crompton 72-kW, 440-V, d.c. dynamo. The engine is totally enclosed, with all the moving parts protected and self-lubricated under a pressure system. The fuel oil pumps are grouped together in one unit at one end of the engine, and the valve gear is overhead and entirely encased, the inlet and exhaust valves being operated from valve levers without the introduction of push rods. Starting up is effected by means of compressed air, which is applied to all four cylinders, thus giving rapid acceleration; the engine can be started from cold and raised to full speed within a few seconds. The exhibit is typical of a range of Crossley vertical engines of various power ratings with from two to

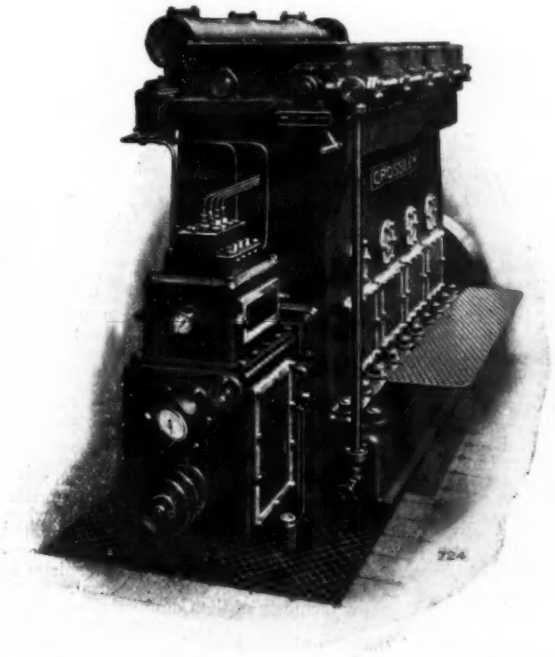


Fig. 13.—A New Crossley Vertical Oil Engine.

six cylinders suitable for driving generators. The other engine is for a normal working load of 44 b.h.p. This engine is also of the enclosed type, to protect the moving parts from dust and dirt, and a very complete system of automatic lubrication has been provided. The sideshaft and gear wheels are entirely abolished; instead, the camshaft, which is arranged across the top of the cylinders, is driven by a silent roller chain, which is enclosed, and works in an oil bath. In both models chain adjustment gear is provided which does not in any way interfere with the valve timings.

Royal Commission on Transport.

An Outline of Evidence Submitted on Behalf of Municipal Electric Tramway Authorities.

ON January 31st and February 1st evidence was given before the Royal Commission on Transport on behalf of the Municipal Tramways and Transport Association.

Mr. W. CHAMBERLAIN (president of the Association and general manager of the Belfast City tramway and transport undertakings) drew attention to the disabilities under which electric tramway undertakings operated under the Tramways Act of 1870. Special emphasis was laid upon the obligation to maintain the track, notwithstanding that under modern conditions the greatest wear of track was due to other traffic, tramcars only using the rails; also tramways had to pay rates and taxes on their tracks and, so far as municipal tramway undertakings were concerned, they were compelled to go to Parliament, at great expense, to obtain powers if they desired to run omnibuses either within or without their areas. Neither tramway companies nor private 'bus operators were compelled to do that, and special reference was made to the case of the Ramsbottom Urban District Council, which promoted a Bill in Parliament in 1926 for motor-omnibus powers, the cost of obtaining which was £2,025, or 2s. 7d. per head of the population of the district. Another instance mentioned was that of the Leeds Corporation, which last year was compelled to go to Parliament for authority because it wished to change overhead electric trolley vehicles to motor-'buses in the Wharfedale area; the expense involved was increased by the fact that interested people opposed and endeavoured to obtain a restriction of the powers which the Leeds Corporation already possessed. It was contended by the Association that powers should be given to the Minister of Transport to authorise, by the issue of Orders, local authorities to run omnibuses, within or without their areas, along any road which was an extension of any tramway, trolley vehicle, or omnibus route for the time being owned, run over, or worked, by the local authority. This proposal was provided for in the Omnibus Bill of 1926, which was, however, defeated upon second reading by five votes, but the Association strongly pressed the view that those powers should be conferred upon the Minister of Transport in the interests of time and economy.

Municipal transport authorities should be protected against competition by omnibuses run by other concerns, whether inside or outside the local authorities' areas and for a quarter of a mile beyond termini, the point being made that the gathering ground of a tramway extended at least that distance beyond the actual terminus. Under the Railway Companies (Road Transport) Acts of last year, such protection was given inside municipal boundaries against omnibuses run by the railway companies, but the Association urged that protection should be extended to the whole of a municipal tramway undertaking. In support of the claim, reference was made to the Nottinghamshire and Derbyshire Tramway Company's Act of 1928, which, it was stated, in effect, prohibited competition by 'buses with the tramways, trolley vehicles, and 'buses operated by the company, so long as the company provided a service which adequately met the requirements of the routes over which the company operated. That Act stipulated that the licensing authority of the district should also grant 'bus licences subject to conditions as to the routes upon which such additional 'buses should, or should not, ply for hire. It was further pointed out that the Greenock and Port Glasgow Tramway Company's Act of 1928 also contained provisions designed to limit competition with that Company's 'bus service.

Mr. Chamberlain then described the conditions relative to licensing street passenger vehicles in Northern Ireland: the right to licence had been taken away from local authorities and was now exercised only by the Government, which, when issuing any licence, also issued a route card indicating the service which the 'bus must provide. Such complete concentration of licensing and control of routes of motor vehicles in Northern Ireland Mr. Chamberlain regarded as ideal. Many questions were asked by members of the Commission about the possibility of applying the same system in this country. Mr. Chamberlain said that the views of the Association were that licensing should continue to remain in the hands of local authorities; however, he suggested that some form of control might be exercised by the creation of Area Joint Committees which would control through-running arrangements and long-distance journeys in the interests of particular areas; at the same time, there would have to be some over-riding authority which would have the right to give a final decision on any points upon which the Area Joint Committees were unable to agree. In making those suggestions Mr. Chamberlain more or less expressed his own opinions, but there was already a tendency in that direction in the inter-running arrangements that had existed for a long time between various tramway undertakings throughout the country. He felt it difficult, as a municipal employé, to express opinions regarding policy which might have to be adopted by those employing him. Several members of the Commission endeavoured to persuade Mr. Chamberlain to express his own personal views on the matter, having regard to the fact that he had stated the system in Northern Ireland to be ideal, but Mr. Chamberlain replied that he could only express the view of the Association, which was that licensing power should be retained by local authorities. Eventually it was agreed that Mr. Chamberlain should submit a statement to the Commission, expressing his own private views on licensing and control, but he asked that the statement should be regarded as confidential and not for publication.

Referring again to the difficulties under which municipal authorities had to work, compared with private 'bus operators, when endeavouring to provide services outside their borough boundaries, Mr. Chamberlain mentioned an instance in which the Cardiff Corporation desired to run motor-'buses between Cardiff and Newport and was asked by the St. Mellons Rural District Council to contribute £66,916 for adapting a route of nine miles. The suggestion was rejected and a Ministry of Transport inquiry fixed the amount at £15,000, but it was felt that the service would not stand that expenditure, and the project was abandoned. Very soon afterwards, however, private proprietors put 'buses on the same route without having any such condition placed upon them; in fact, he believed nothing had been done to adapt the route in the manner suggested when the Cardiff Corporation made the first proposal. Among other disabilities of municipal tramway undertakings, compared with private 'bus owners, Mr. Chamberlain mentioned the compulsion to run tramway services for workmen at unremunerative fares, the fixing of maximum fares, the provision of regular and comprehensive services, the supervision of design and character of rolling stock by the Ministry of Transport, the fixing of compulsory stops, and the reporting of all accidents to the Ministry of Transport, none of which conditions applied to the operators of competing 'buses.

Continuing, Mr. Chamberlain said the Association was in favour of an efficient system of controlled co-ordination of the services for road passenger transport operated by financially substantial people who could meet their obligations, ensure regularity of services, and recognise proper rates of pay and conditions of service for their employés. Members of the Association were not prepared to enter into co-operation with operators who did not pay fair rates of wages and observe fair conditions of service. The aim of such co-operation must be pre-eminently to serve the public and enable the maximum use to be made of all the means provided for road passengers, whether within or without the area of any local authority. Personally, said Mr. Chamberlain, he would agree to co-operation with the railways, regard being had to the adequacy of the railway or tramway service in a particular district, whichever was the first in the field. Regarding the manner in which the owners of licences for a few 'buses were able to sell their 'buses and licences to larger undertakings at a very much enhanced price (because of the existence of the licence) the Association, said Mr. Chamberlain, held the view that a licensee had no right to sell a licence and no right to claim good-will in respect of the route for which a 'bus had been licensed. There were cases, however, in which as much as £2,000 more than the value of the 'bus had been paid because of the sale with the 'bus of the licence. That position had been completely modified in Northern Ireland, because when a 'bus changed hands the route card had to be returned to the licensing officer and the new proprietor had to apply for it again. Mr. Chamberlain added that at one time in Northern Ireland licences were bought for the purpose of selling them again at a very much higher figure.

To a number of questions about the prospect of electric tramways ceasing to exist in a relatively short time, Mr. Chamberlain replied that he had endeavoured to fix such a date in his own mind, but had failed to do so. One of the first things he did when he went to Leeds four years ago was to spend £500.000 on new tramcars, and that expenditure had been justified. It was necessary in tramway matters to look ahead 20 or 25 years, because a tramcar would last that period, and he believed that the 200 new tramcars would be operating to the benefit of the public in Leeds in 25 years' time, in addition to fleets of motor-'buses and other means of transport. In the case of Manchester, mentioned by one member of the Commission, Mr. Chamberlain said three motor-'buses would be required to carry the same number of people now carried by one tramcar, and he hesitated to conceive the state of congestion of the traffic in Manchester if tramways were abolished and motor-'buses substituted.

The fact that motor-'bus licences are issued by the Watch Committees of the large Corporations in the provinces was suggested by some of the members of the Commission as affording municipal tramways considerable protection, but Mr. Chamberlain's experience had been that Watch Committees

issued licences without consultation with Tramway Departments and often without any regard to the adequacy of the tramway service over the routes for which 'bus licences were granted. The Association regarded the motor-omnibus industry as a heavily subsidised one, because the taxes paid in respect of 'buses fell far short of the charges which fell upon tramcars, the average figure being £347 per tramcar per annum when the cost of road maintenance and rates and taxes were taken into account. Asked which he thought was the better form of traction (electric tramcars, railless trolley vehicles, or motor-'buses) Mr. Chamberlain replied that there was a field for each of the three methods of passenger transport, according to the particular local circumstances. He admitted that some of the small towns now running tramways would not have installed them had motor-'buses been available at the time the tramways were built, and he also mentioned that one of the inducements to change over to the railless trolley system was that the obligation to maintain the tramway track and to pay rates upon it did not exist in that case.

Discussing long-distance traffic, Mr. Chamberlain said that if some central authority decided that it would be in the interests of the community for any particular local authority to run 'buses long journeys, even from Newcastle to Derby, or Newcastle to London, local authorities would be prepared to undertake that work; but, of course, the primary obligation of local authorities was to provide transport for people residing within their boundaries and also for those smaller places in their vicinities which had community of interest with the larger towns.

This concluded the evidence on behalf of the Municipal Tramways and Transport Association. The Commission adjourned until February 13th, on which date it is understood that evidence will be given on behalf of the Tramways and Light Railways Association.

D.C. Cable-Testing Equipment.

A portable high-voltage thermionic a.c. rectification outfit made by Watson & Sons (Electro-Medical), Ltd., for testing power cables.

HIGH-PRESSURE cables for electrical power transmission have to be tested at pressures considerably higher than their normal working voltage, but, in many cases, the use of alternating current for testing is precluded by the difficulty of transporting to the site of the test plant capable of generating, or transforming, the necessary power. By the use of high-voltage d.c., however, the power required for the test is small, being that necessary to compensate for leakage in the cables and possible corona discharge at the ends. Considering that one of the most satisfactory portable systems of obtaining a high uni-directional pressure is that which utilises rectified a.c., achieved by means of hot-cathode valves, Watson and Sons (Electro-Medical), Ltd., are now manufacturing a small portable set suitable for testing all cables which operate at pressures up to 22,000 volts. The equipment consists of :—

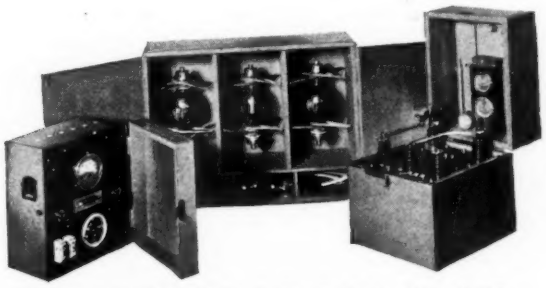


Fig. 1.—High-voltage D.C. Cable-testing Outfit.

(i) A transformer of special design, oil immersed, capable of delivering an output of 30,000 volts (r.m.s.). Included in the same tank are two other transformers for energising the filaments of the two thermionic valves, their leads being brought out through two ebonite bushes in the "Paxolin" top of the transformer and connected to two Edison screw sockets mounted on the top of the bushes. A small voltmeter reading 0/20 volts is connected across the filament of each valve; one end of the main transformer and the secondary winding is connected to an earth terminal, and the high-pressure end brought out through an ebonite bushing; in addition, two ebonite pillars are mounted on the transformer top to form supports for auxiliary apparatus. The transformer is mounted in a stout wooden case, fitted with a lid with sliding hinges, and the various l.p. connections are brought out to a 5-pin socket. The lid of the case forms storage space for various parts during transport, namely, four protective "Silit" resistance rods, two aluminium connecting tubes, a rod for earthing the cable after test, and a case containing two milliammeters fitted with a shunt switch and arranged to read 0/5 and 0/50 milliamperes.

(ii) The control switch-panel is contained in another wooden case, also fitted with a removable lid; on the black "Sindanyo" panel is mounted the main switch, filament switch, primary voltmeter, fuses, filament rheostats, and a potentiometer with hand-wheel control. Primary control is by means of the potentiometer, so that the voltage on the cable may be varied evenly from zero to the required test pressure. It should be noted that when testing cables by means of high-voltage d.c., the pressure should be increased slowly until the required value is reached.

(iii) The valve case is made of wood, stoutly designed and arranged to accommodate three valves, each supported by means of rubber rings placed around each end and stretched to hooks provided on the sides, the valves being thus slung so that mechanical shock due to rough handling of the case is not communicated to them, with consequent likelihood of damage. At the bottom of the case four small compartments accommodate the sphere-gap voltmeter parts and the flexible cable with a 5-pin plug at each end.

To erect the apparatus ready for a test, the various cases are opened, their lids removed, and the main transformer assembled as follows: the two valves are screwed into their ebonite sockets and the ammeter is plugged into the centre bushing at the front of the transformer; the base of the sphere-gap voltmeter is fixed to the front of the set and the spheres fitted to the base and then clamped into position by means of wing nuts; a "Silit" resistance rod (fitted with a plug at one end and a socket at the other) is placed at the reverse right-hand bushing, two aluminium tubes being used for the remaining high-voltage connections from the top of the (*a*) "Silit" rod to the top of the right-hand valve, and (*b*) milliammeter to the top of the left-hand valve; the remainder of the "Silit" rods are fixed into spring clips, making connections between the set and the sphere-gap voltmeter.

The equipment is provided with the necessary connecting leads between the transformer and control panel, encased in a protective metal sheath at each end of which is a 5-pin plug to which the leads are connected; one plug is fitted to the socket of the transformer and the other to the socket of the switch panel.

Complete assembly of the apparatus ready for a test may be carried out in five minutes; the weights and dimensions of the three parts ready for transport being as follows: transformer, 220 lb., 20 in. by 17 in. by 26 in.; control panel, 90 lb., 20 in. by 20 in. by 24 in.; and valve case, 40 lb., 29 in. by 40 in. by 14 in. Fig. 1 shows the three cases with their lids and doors open, whilst fig. 2 shows the transformer and control panel assembled for a cable test. In operation, the apparatus is reliable, and may be used for pressure tests up to 60,000 volts from core to core, or 30,000 volts from core to earth. It may also be used in connection with a h.p. bridge for the rapid location of faults.

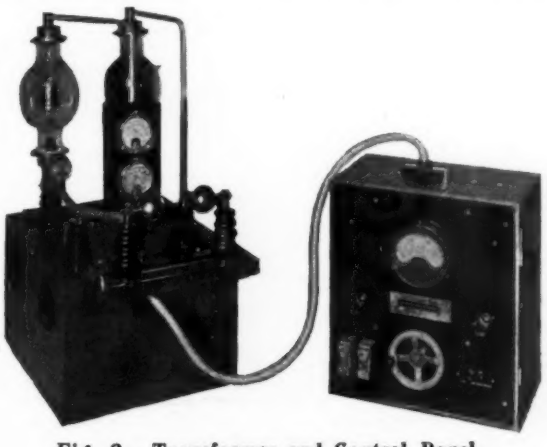


Fig. 2.—Transformer and Control Panel.

Oxide-coated Radio Valve Filaments.

A review of recent development, outlining present methods of manufacture for commercial purposes, and indicating views on the mechanism of electron emission from alkaline earth oxides.

By B. HODGSON, O.B.E., B.Sc., Ph.D., L. S. HARLEY, B.Sc., (Eng.), A.M.I.E.E., and O. S. PRATT, B.A.

(*Extracts from Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ALTHOUGH some of the earliest valves probably had carbon filaments, when valves first came into commercial use it was to the oxide-coated filament that manufacturers turned as the most convenient source of electron emission, which varies with temperature according to the following law :—

$$I = CT^{\frac{1}{2}} e^{-D/T} \quad \ldots\ldots (1)$$

where I = emission current per unit area,
C and D = constants dependent upon the emitting material, and
T = absolute temperature.

The chief exponents of this branch of electron physics assumed that free electrons exist in a metallic conductor and are in a state of violent motion like the molecules of a gas, or liquid, which becomes more violent as the temperature rises, and that the energy of the motions finally attains a value large enough to carry some of the electrons through the surface of the hot body, just as the energy of a water molecule at 100 deg. C. is sufficient to carry it through the surface skin into the space above; in an analogous way electrons have to overcome forces acting at the boundary, as do the molecules of a vaporising solid or liquid. The law quoted above can also be expressed in a different form, by making different assumptions concerning the number of free electrons per unit volume as follows :—

$$I = AT^2 e^{-b/T} \quad \ldots\ldots (2)$$

In this form the number of free electrons is assumed to be proportional to $T^{3/2}$, whereas in equation (1) it was assumed to be independent of T; in the second equation (now more generally accepted) A is a constant theoretically independent of the material, and has been shown to have the value :—

$$A = 2\pi mk^2 e/h^3 = 60.2 \text{ amps. per cm.}^2 \text{ per deg. C.},$$

where k = Boltzmann's constant,
h = Planck's constant,
m = mass of an electron, and
e = charge of an electron;

also $b = \phi e/k$, where ϕ = voltage-level which the energy of the electron must attain to break through the forces resisting its escape from the emitting surface.

The evaluation of the emission constants is fraught with difficulties : one of the most difficult conditions to fulfil is that of obtaining and maintaining constant surface properties of the emitting substance, for the oxide cathode undergoes a formation process during its operation and, as the velocity of formation varies both with the temperature of the cathode and with the current drawn from it, time must elapse before the steady condition is attained.

The constants obtained vary considerably in different experiments; the authors collected some of the results, which are shown in Table I.

TABLE I.

Authority.	A.	b.	Current per cm² at 1 000° K (obtained from the formulæ) amps.
Koller	4.27×10^{2}	35,900	1.15×10^{-6}
	1.07×10^{-3}	12,100	6.4×10^{-3}
Espe	20×10^{-3}	11,500	2.08×10^{-1}
	0.2×10^{-3}	11,500	2.08×10^{-3}
	C	D	
Wehnelt	7×10^{26}	4.5×10^{4}	2.3×10^{-1}
Jentzsch	2.94×10^{26}	4.16×10^{4}	3.1

The barium-oxide filaments of commerce give emission currents of the order of 1 amp. per cm.²

Table II gives some values for different materials to show how they vary; A varies with the material and does not keep the constant value 60 as theory indicates.

Within the last few years the idea of chemical action has been considerably modified, and we now believe that the emission is "thermionic," as in the case of tungsten or carbon, and that chemical action plays only an indirect part in the mechanism of emission. The theory to-day is as follows : the barium oxide is decomposed electrolytically and oxygen is diffused into the vacuous space, whilst the alkaline earth metal remains at first in the place where it was liberated, but subsequently diffuses to the surface, where it forms small islands or colonies which are emission centres in the sense of Richardson's law (*i.e.*, thermionically). Everything that helps the building of these islands increases the emissivity of the filament : everything that tends to destroy them reduces it. The emission from this type of filament thus becomes steady and constant when equilibrium is reached between the evaporation of the metal and the building of new metal islands under the electrolysis set up by the emission current.

One difficulty hard to explain is : why does such a volatile metal as barium remain on the surface after formation?

TABLE II.

Material.	A. Amps./cm²/deg. C.	b. Deg. C.	φ Volts.
Tungsten	60.12	52,560	4.53
	—	56,000	4.46
	100	53,100	4.57
Thorium	70	39,400	3.27
		34,100	2.94
Calcium oxide	—	21,400	1.77
		—	2.24
		—	2.4-2.5
Strontium oxide	—	15,300	1.27
		—	1.79
		—	2.15
Barium oxide	—	12,000	0.99
		—	1.59
		—	1.85
Mixture of barium and strontium oxides	0.001	12,100	1.04

Barium melts at about 1,120 deg. K and vaporises rapidly at 1,220 deg. K. The authors have been unable to find any measurements of the vapour pressure of barium at about

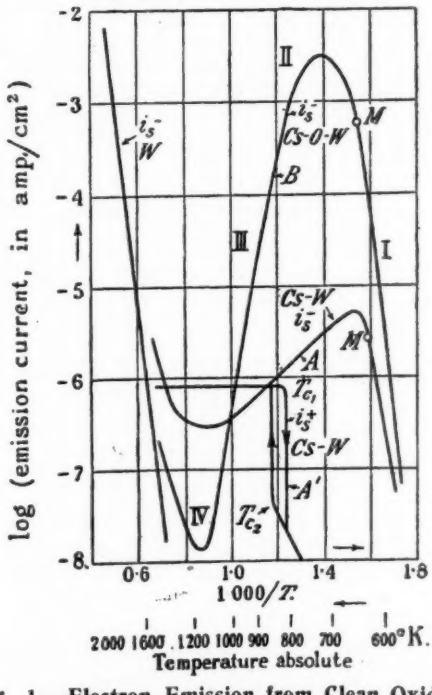


Fig. 1.—Electron Emission from Clean Oxidised Tungsten in Cæsium Vapour.

1,000 deg. K, but for calcium it is 47 mm. of mercury; and it will be about that amount for barium. It would therefore appear to be necessary to explain why barium remains on a filament at a temperature at which it should be liquid, and should vaporise with rapidity. The barium may not be in the form of drops, or separate particles, but perhaps in some absorbed atomic condition which holds it fast to the surface. Cæsium, rubidium, and potassium adhere to tungsten at quite high temperatures, higher than one would expect from the known vapour pressures of the metals. In 1926 Becker measured the electron current both from a pure tungsten wire and from an oxidised tungsten wire in cæsium vapour; what he found is most easily seen from fig. 1. The curves are in

three parts: from right to left, a rising part I shows an increase of emission with temperature; at II a change occurs, and the falling part III shows a diminution of emission with increasing temperature; at IV the curve changes abruptly and again an increase in emission with increasing temperature results. With pure tungsten similar results occur, but the emission at from 700 to 800 deg. K is considerably smaller than with oxidised tungsten. In stage I emission from a layer of cæsium on tungsten, or oxidised tungsten, persists to a higher temperature than with the unoxidised wire. At stage III the cæsium surface is getting smaller, and in stage IV the emission is that from pure tungsten. The experiments show that cæsium in contact with oxygen can be raised to a higher temperature on a tungsten filament than in the absence of oxygen, without loss of the cæsium by evaporation.

Direct support is given to the theory outlined above in two ways: first, barium and barium-oxide valves appear to have similar properties, and, secondly, oxide is essential as a support or carrier for the barium, which would otherwise vaporise.

The small value of the constant A for barium-oxide filaments has led to the suggestion that the islands, or colonies, of barium only cover 1/1,000th of the surface of the filament. If it were possible to cover the whole surface of the filament with barium, then it is inferred that an emission of 1,000 amperes per cm.^{2} would be possible. With barium filaments the authors find no such increase in emission, and they have no reason to believe that the barium does not cover the whole of the filament. Tungsten appears to be the only substance that gives the theoretical value of 60, and it is probably dangerous at this stage of knowledge to form any conclusions from variations in the value of A.

Manufacture can be carried out in one of four ways, namely, (1) The melting, or fusing, of a barium compound to the core wire; (2) the application to the wire of a resinous, or paraffin, paste containing a barium compound; (3) the evaporation of a solution of a barium salt which is painted on the wire; (4) deposition on the filament of barium from vapour.

In the melting method the core wire, which may be platinum or nickel, is drawn through the fused salt bath; the nitrate of barium is often used. This process tends to make filaments rough in appearance, with loosely adherent coating, and the authors believe that it is not now in very common use.

The paste process is more common; great care is taken to obtain very small particles of the barium carbonate usually used. The carbonate is ground in a mill for from 24 to 48 hours and then the finer particles of the ground mass are selected and made into a paste with paraffin or resin, kept in a molten condition, and allowed to stand. The bigger particles sink first to the bottom, and the upper portion, which contains only the finer particles in suspension, is again mixed to make a uniform paste and is applied to the heated filament wire so that a portion of it adheres. The wire is then heated more strongly to evaporate, with a minimum of carbonisation, the paraffin or resinous carrier. Finally, the core is heated to about 1,000 deg. C. to sinter the emitting substance to the wire and to convert the carbonate to oxide. This process is repeated several times. A process of this nature is used by the Western Electric Co. (Standard Telephones & Cables, Ltd.), and may be carried out by hand or automatically in a series of ovens and pasting pots. With the use of such a machine, 80 metres of filament wire may be prepared per hour, greyish in colour and slightly rough in texture, but if well done the coating is regular along the length of the filament. If the layer is too thick, it tends to crack, giving the appearance of a number of cylinders threaded on a wire. The core metal is usually platinum or nickel, molybdenum or tungsten being rarely used owing to the risk of burning them during the necessary heat treatment.

With both the first and second methods the barium-oxide filament must be protected, before pumping, from the action of carbon-dioxide and water vapour.

The third method, using solutions of salts, is still in use and is probably the oldest of all; the wire is dipped in the solution, taken out, and heated in carbon-dioxide gas. This is repeated, perhaps, 50 or 100 times, and finally a layer of carbonate is formed, almost insoluble in water. With this method the wire must be scrupulously clean before the coating is begun, and the heating carefully carried out, otherwise a "pearl-string filament" is obtained. A filament made by this method is not vitiated by contact with the atmosphere.

The fourth method is the only one in use in which the oxide coating is formed *in vacuo:* the core wire is oxidised before the evacuation of the bulb; for example, tungsten may be used as a core and oxidised in lengths before assembly on the valve-foot, or oxidised on the valve-foot after the assembly has been completed. On the side of the anode towards the filament a piece of barium metal is fixed; when a good vacuum has been obtained, the anode is heated, usually by high-frequency induction, and the attached metal evaporates and surrounds the filament, which is kept at a dull red heat, whereupon the tungstic oxide is reduced and barium oxide is formed upon the filament. Another means of producing the barium vapour is to use barium azide solution, which is painted on the anode and used instead of barium metal. On evaporation, crystals of barium azide are left upon the anode, which is subsequently heated *in vacuo.* Barium azide is a compound of barium and nitrogen, decomposing at about 225 deg. C. into metallic barium and nitrogen. The barium itself acts as a "getter" after this decomposition, but it is usual also to employ magnesium to produce a silvery mirror in the bulb, instead of the brown or black mirror produced by barium alone.

With the first three methods the pumping takes a considerable time. The porous nature of the fused, pasted, or evaporated, coatings makes it necessary to exercise some considerable care in this part of the process. The filament is heated to 900 or 1,000 deg. C. without anode voltage, and the pumps take away the gas evolved. After this stage the anode may be heated, either by induced high-frequency currents, or by bombardment. There is usually sufficient emission at this stage to bombard the anode, especially as the gas still in the bulb enables the current to attain large values by ionisation. Activation commences as the vacuum improves, and as the filament improves in emissivity it can be run progressively cooler before the valve is sealed off. Completion of the process by ageing can be carried out in the usual way, by heating the filament to its normal running temperature and applying a positive voltage to the anode.

If the coating is not of uniform thickness, those parts where the surface is more remote from the core are cooler than the more thinly coated parts. This causes greater emission from the thinner parts, and thus "hot spots" are produced in all types of barium-oxide filaments, and is perhaps the reason why such filaments have not so far been used in valves intended for operation at very high anode voltages. An attempt has been made to remedy this defect by making the emitting layer of a composite nature: the Western Electric filament is coated with barium oxide and strontium oxide, and the filament of the Round valve with barium oxide and calcium oxide. It is stated that the use of mixtures and thin layers minimises the knot or pearl-string formation which is so liable to cause "hot-spot" action. With filaments made by the vapour process the thickness of the layer of emissive coating is under control; the authors have shown it to be a few hundreds of molecules thick.

Filaments made by the vapour process have reasonably constant emission over long periods of life. In the case of those made by the paste method, especially when thin cores are used, the variation from valve to valve is greater. With valves made by the barium-vapour process, the authors have not been able to detect any change in the amount of barium present in a filament after 1,000 hours' life by the direct estimation method, and measurements of the total emission of similar filaments show little change in the emission.

The Faraday Centenary.

Preliminary Arrangements for the 1931 Celebrations.

A MEETING of British engineers and scientists was held at the Royal Institution on February 15th, under the presidency of Sir Arthur Keith, to arrange for the celebration in 1931 of the centenary of Michael Faraday's great discovery of electro-magnetic induction. A number of societies and organisations were represented, including the Royal Society, the British Association, the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Electricity Commissioners, and the British Broadcasting Corporation.

Sir Arthur Keith, outlining the business of the meeting, said that Faraday was one of the greatest of Englishmen. It was fitting that they should meet at the Royal Institution, for it was there that Faraday, not only made his workshop, but also his home for 54 years. It was there that he made the discovery which had revolutionised the conditions under which people lived. Faraday was the Institution. He was glad to see representatives of the British Association present, because the centenary of that body also fell in 1931, and it was hoped that the Faraday celebrations might form part of the B.A. meeting in that year.

Sir William Bragg, director of the Royal Institution, indicated that the last two weeks in September of 1931 were thought to be the most suitable time for the celebrations. A suggestion by him that two committees should be formed, one to organise the scientific side of the celebrations, and one to organise the industrial tribute, was agreed to. The centenary, said Sir William, according to *The Times*, should cause them great pride. Faraday's work had touched so many developments in science and industry that a great many of bodies were interested. Everybody who had been approached had promised help, and he felt that they would start with the sympathy and encouragement of many organisations throughout the world. They were hoping that the electrical and engineering associations would be willing to take charge of the industrial side of the work.

If they could make the centenary a great success they would encourage the people to go on with their work, and would brighten the whole outlook of the nation as to the part it played in the science of the world. It was hoped that the British Association would meet in London that year; if so, the combination would be a very happy one.

Sir Ernest Rutherford, president of the Royal Society, said it was fitting that the Royal Institution should take the lead in the celebrations; Faraday made the announcements of many of his discoveries in the lecture room in which they met. The centenary of his discovery of electro-magnetic induction was a particularly well-chosen time. Probably no scientific discovery had had so much practical effect on the world as that primary discovery. Plans were also being made for the celebration in 1931 of the centenary of the birth of James Clerk Maxwell, one of the greatest figures in natural philosophy since Newton. In a sense he was the interpreter of Faraday, and put in mathematical form the latter's ideas. The enormous development of radio-telegraphy had practically depended on the utilisation of Clerk Maxwell's electro-magnectic theory. It was fortunate that the two centenaries fell comparatively close together, and though the Clerk Maxwell celebration would be most appropriately carried out at Cambridge, he would like the committees to take into consideration the possible combination of the two events. It would be a great thing to celebrate at the same time two such great men of the scientific world.

Promises of support were given on behalf of the bodies they represented by Lieut.-Col. K. Edgcumbe, president of the Institution of Electrical Engineers; Sir John Snell, representing the Ministry of Transport, the Electricity Commissioners, and the Institution of Civil Engineers; and Sir William Pope (Cambridge University), for the Chemical Society and the Society of Chemical Industry.

Mr. D. N. Dunlop, speaking as the president of the British National Committee of the World Power Conference, mentioned that for international purposes similar committees in America, France, Germany, and elsewhere would be glad to help.

Sir John Reith pledged the B.B.C. to co-operate so far as possible.

Lieut.-Col. W. A. Vignoles, Electrical Development Association, hoped that the committees would be able to discover some way of bringing home to the public those developments which had followed Faraday's discovery, and to show that people in their daily lives on all sides were using the appliances and being helped by the inventions which had come from this one discovery which Faraday made 100 years ago.

Professor F. L. Myers, British Association, said the officers were prepared to recommend to the Council of his Association the most cordial co-operation. It would be a great source of satisfaction to the general officers and, he believed, to the Association if their centenary meeting could be interlinked as closely as possible with the celebration of the period of great discoveries out of which the British Association sprang. It was the hope of the Council that it might be able to use every endeavour to secure that the centenary meeting should be held in London. They would be glad to do everything in their power to ensure that not only the intellectual descendants of Faraday himself, but also the large public which appreciated and was interested in, and benefited from the applications of those discoveries should be fully represented.

Mr. Clifford C. Paterson mentioned that the International Illumination Commission had arranged to meet in England in the first three weeks of September, 1931.

In reply to Sir Richard Glazebrook, who pressed for a definite date in order that their French friends might be informed, Sir William Bragg stated that it would probably be in the third week of September, but certainly in the last fortnight. It was thought possible that these celebrations might occupy the Monday and Tuesday of the third week, and that the meetings of the British Association might follow on the succeeding day.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Gramophone Reproduction.

I regret to see, in Mr. E. W. Braendle's reply in your issue of February 8th to my letter in the previous issue, that some feeling of annoyance is exhibited. If, in the effort to be brief in my previous letter, I wrote too bluntly and gave any cause for offence, I apologise unreservedly. I fear that I must have done so, for surely Mr. Braendle would not otherwise have been led into a lapse from good taste in insinuating that my letter was an advertising one.

Now as to the technical points at issue:—

1. In his article Mr. Braendle quoted Helmholtz to the effect that "the audible quality of any tone depends entirely on the amplitude of the harmonics, not on relative phasing." I disputed the application of this, except for sustained notes of unchanging amplitude. Mr. Braendle replies by a dispute as to the meanings of "note" and "tone." I do not accept his definition; but this is beside the point. The important matter is that one is *not* justified, in the reproduction of notes or tones of varying amplitude as found in music, in neglecting phase change; and herein lies one of the greatest difficulties in the design of apparatus. It is a point which needs attention, and I therefore called attention to it.

2. In his letter Mr. Braendle takes it "that readers of this journal are capable of understanding the terms employed and of devising their own means of testing for these defects," referring to inertia, stiffness, and excessive damping in pick-ups.

While holding a high opinion of the abilities of electrical engineers, I doubt it. It is extremely difficult to find out, without special apparatus, what is the value of these things in a "pick-up," and his suggestion in the original article that "purchasers would be well advised to satisfy themselves that the stylus arm . . . is adequately 'dead' or non-resilient" can only be carried out by each purchaser having access to a special laboratory. A "pick-up" may be very free to slow forces applied to the needle and yet stiff at audio frequencies, or *vice versa*, and my comment was intended to draw attention to the fact that the casual static tests likely to be applied by a non-specialist purchaser give no criterion as to the qualities under conditions of use. It was, I think, a fair comment.

3. Regarding my statement as to recorded frequencies, with existing records the limiting factor as regards low frequencies is the number of grooves per inch, which imposes a definite limit on the amplitude of a "wave" in a record. Since, for equal reproduction, the amplitude of the record "wave" varies inversely as the frequency, there must be a falling off at some point as we go down the scale. The latest information in my hands, obtained from very good sources, is that constant output is maintained down to 150 cycles, and constant *amplitude* below that, so that from 150 cycles downward the output is proportional to frequency instead of constant. My statement was "the recorded range is only 150-4,500 cycles at full volume." If Mr. Braendle has information of newer methods which make that statement incorrect, perhaps he will give it. Otherwise I shall still claim to be "up-to-date."

4. The only possible comment here would be a treatise on amplifier design, and I am afraid there is no space for it.

5. Here, of course, is the basis of Mr. Braendle's accusation of advertising. His first statement was that reed loud-speakers "have not so seriously competed" with coil drives, either for power or quality. Now, in my reply I tried to keep off any "advertising" claims, and to speak as an engineer and musical student of reputation and experience. I repeat that the speaker in question does "seriously compete" with coil drives, and I believe that my firm is not afraid of direct comparison with coil-driven speakers on the market. As regards power-handling capacity, the matter is one of simple fact, and there is no doubt whatever as to my correctness. As regards quality, the matter must remain one of opinion, and all I claimed was that expert opinion was not all in favour of the coil drive; I might have said more. I maintain that my comment was justified, and I think that Mr. Braendle should express regret for his tone in this matter.

6. As to choke-feed output, with the comparatively low-impedance circuits now in use it is hardly practicable to avoid back coupling; for example, with a 150-ohm valve, or valves and 3,000-ohm loud-speaker, working at, say, 350 volts, the r.m.s. audio-frequency current is likely to be 15 mA, or so. This, passing through a 5-μF filter condenser on the mains unit, sets up 3 volts, of which 2 volts is likely to be passed back to earlier stages.

There is no doubt at all as to the advantage of getting rid of this altogether, even though its evil effect may be mitigated by condensers of 10-12 μF, and I think I was right in calling attention to the point. Mr Braendle is not correct in assuming that an audio-frequency transformer causes amplitude distortion if there is no d.c. component through it. The point (involving, of course, the fact that d.c. tends to constancy of permeability) has been raised before and disposed of. It is too complicated to go into here, but the whole subject is excellently treated by Kirke: "Microphone Amplifiers and Transformers," in *Experimental Wireless*, July and August, 1928.

P. K. Turner, M.I.E.E.,
Chief Radio Engineer, GRAHAM AMPLION, LTD.

Slough, *February 8th*, 1929.

Lead Sheaths of Cables.

We have read with much interest the article in which Mr. C. J. Beaver attacks what has been regarded as the firmly-established fact that lead sheaths of cables may be permanently stretched in service. Although Mr. Beaver denies that he knows of any, there is a considerable amount of published evidence in support of this fact; and the statement made in our last paper was not "merely speculative," but based upon experience and a special test of our own which will be included in a paper to be read in March.

Let us examine the nature of his evidence against permanent expansion. If it be assumed, following Mr. Beaver, that his cable is initially full, the only ways in which room can be provided for compound expansion without permanent stretch of the lead are by the increased volume due to expansion of the lead sheath (i) as the temperature rises, (ii) under internal pressure. In this case (ii) is only about one-tenth of (i), so that change of lead thickness makes very little difference. They may be very simply calculated from the constants given in the articles: for a rise of 75 deg. F. (see fig. 4), coupled with an internal pressure producing a strain up to Mr. Beaver's figure for the elastic limit, the increase in volume of a six-foot sample of cable A is about 1.533 cubic inches; the

volume of compound in such a sample (allowing for copper and paper space) is of the order of 191 cubic inches, from which it may be deduced that to avoid permanent stretch the compound must have a volume coefficient of expansion not exceeding 0.000112 per deg. F., which is less than one-third of the normal value for insulating oils. It may be that "diatrine" is such a compound, but Mr. Beaver must forgive us if we are sceptical on this point. The estimate errs in Mr. Beaver's favour, since paper and copper expansion are neglected and the lead sheath is assumed to reach the copper temperature. If this coefficient of expansion is exceeded, then the lead must be permanently stretched.

The only other explanation of Mr. Beaver's results which is possible is that there are air spaces in the cable initially. We appreciate that he attempted to ensure complete filling before commencing his experiment, but with a compound of so high a set point as "diatrine," which is extremely viscous to well above the working temperature (over 2,000 secs. Redwood at 180 deg. F.), it is difficult to see how any entrapped air can ever escape; indeed, on page 98 the author admits as much when he says: "It may be noted that even if the enclosures above referred to are appreciable *in toto*, the employment of an impregnating compound which is highly viscous under the maximum working temperature conditions will ensure that they can never aggregate as they would tend to do in a thin mobile medium."

Another point on which Mr. Beaver makes no comment is that in every case he obtains a vacuum on cooling. Why is this, if there is no change of internal volume?

His maximum pressure without distention is of the order of 35 lb./sq. in., which is less than has been reported by other competent investigators on long lengths of cable in service. The 1927-28 report of the Underground Systems Sub-Committee of the N.E.L.A. says: "High pressures of the order of 60 lb./sq. in. can be developed in ordinary cable with normal loading; these pressures are not uniform along different parts of the cable even under uniform exposure and equal conditions. High pressures cause stretching of the lead sheath." Similar results have been reported by many operating companies in the United States.

As regards the reference to Dr. Junius's paper, fig. 2 illustrates the behaviour of a very badly impregnated cable. Similar checks on impregnation have been carried out in the factory with which we are associated for many years (see British patent 275,721) and on a cable whose impregnation is really "well advanced" the change in capacity is under 2 per cent. for a change of pressure between vacuum and 100 lb./sq. in.

For the reasons given we are driven to the conclusion that the explanation of Mr. Beaver's results is that there is occluded air in the highly viscous dielectric of his experimental cable, which cannot be removed by the methods he employed.

T. N. Riley.
T. R. Scott.

London, N.W.9, *February 4th*, 1929.

Service Boxes.

Lead service boxes are not necessarily more watertight than c.i. boxes, as "Service" seems to think. A lot depends on the plumber jointer, and *cast*-lead boxes may be porous, which defect is not met with in boxes pressed out of sheet lead. In most localities it is necessary to use a c.i. protection shell, which considerably adds to the total cost.

Cast-iron service boxes, with suitable glands, can be made quite watertight, and that without the skilled (and costly) work of a plumber jointer. Wood bushes are not used in the most modern designs of c.i. boxes, and one make at least does away with the necessity for any drilling of lead or wood bushes with a gland consisting of a shuttle which is screwed down on to lead strip wrapped round the sheath. This, of course, does away with the need for stocks of bushes to fit every size cable in use, a fact which has been pointed out in some bright advertisements that have appeared recently.

If volume of advertising bears any relation to volume of sales, then I think "Service" is incorrect in inferring that lead boxes are used in larger numbers than c.i. boxes; but, on the question of advertising, probably "Service" is not altogether ignorant.

There is one thing to be said in favour of lead boxes made on the job. Their use helps to make one service connection keep both jointer and mate comfortably occupied for one whole day.

T. J. B.

February 8th, 1929.

The letter over the signature "Service" on page 263 of this week's REVIEW is evidently inspired, for the writer admits that he is in possession of facts concerning the purchases of supply undertakings generally, and so he must be apparently a manufacturer, or factor, of such apparatus. That being so, it is evident also that he is attempting to deceive, for from statistics I have read recently I find that he would have been nearer the true state of affairs if he had said "one finds that a few undertakings are still using lead service boxes," instead of making use of the insinuation whi h he does.

Acting on this evidence, I assume that his other implications are liable to be inaccurate. Let us see exactly what "Service" states:—

A.—"Cast-lead service boxes protected by c.i. shell appear to make a far more reliable job." Does "Service" appreciate the difference between sheet and cast lead?

B.—"Can it be said that a properly designed and properly filled c.i. service box is as reliable, in waterlogged ground, as a cast-lead box, plumbed on to the main and the service cable?" Surely "Service knows that a plumbed joint is not necessarily watertight, whereas a c.i. box can be made so, and that cast-lead is porous, especially when dross gets into the castings?

C.—"What is the objection to them (cast-lead boxes)"? Over and above the objections already stated, there is the initial cost of the boxes and the cost of installation. All supply authorities do not employ plumber jointers.

Following on the method adopted by "Service," of the use of a nom-de-plume, I sign myself,

Deuce.

London, *February 9th*, 1929.

Architects and Electrical Specifications.

In the preparation of plans for new buildings, whether intended for factory requirements or dwellings, the architectural profession very frequently has control of the electrical specification, in addition to the building one. Sometimes such electrical specifications are very well drawn up, and have evidently had an electrical man working in collaboration with the architectural draughtsman. On the other hand, there are so-called specifications which are useless for purposes of quotation, or anything else. Whether architects should issue these under their own names only, is a matter of some importance to the electrical profession in general, and to the contracting fraternity in particular; but, writing as one of the latter, the point I wish to protest against is the time allowed the contractor; he has to read and digest a specification, visit the prospective job, weigh up runs, quantities, and labour, and in spite of other pressing work, to have a tender prepared and sent in, amounting to hundreds of pounds, in the working space of 72 hours!

In nearly every case the architect has "sat on" the job for months; but the contractor is given *hours* for his part of the job! (The electrical contractor being, of course, an afterthought.)

Can anyone wonder why there are such wide discrepancies in prices given in tenders for various jobs?

Blind guess-work is evidently practised by many people tendering, if they are to have their tender delivered to time.

The articles which you publish from time to time on the economics of the contracting side of the electrical industry would prove valuable if the theories put forward in them could be put into practice—but blind rush seems to be the fate of the poor contractor, against the leisurely and dignified procedure of the architectural profession.

"Live and Let Live."

February 7th, 1929.

Side or Bottom Heating?

I have followed with interest the discussion which has been going on regarding the above subject in your journal, and am pleased that we have had the opinion of Mr. W. Ellerd-Styles; having read his paper on "Large Baking Ovens," I must admit he is well versed in heating problems, and I feel that the remarks of Mr. S. F. Bickell are open to the same criticism as he lays at the door of Mr. Ellerd-Styles.

Opinions are asked for, and I must say we have all a lot to learn as regards electric cooking and heating, both domestic and industrial, but by expressing candid opinions and views we are bound to achieve some little good. We cannot get away from the fact that nearly all domestic cooker manufacturers have constructed their cookers on the principles of the gas cooker, which forms a cold pocket at the bottom of the oven when the present system of side heating is being used, which is purely a system of direct radiation to the oven interior, or element guards. We must consider the best system of baffling our elements, and I see no reason why we could not construct an oven entirely with side heat which would give us satisfactory heat throughout the oven and assure us of even distribution all over the oven, including the bottom, even when using two or more trays of goods in the oven at the one time, because, as Mr. Bickell states, one cake in the oven is no test, but I say an ovenful sometimes is a catastrophe due to uneven heating. Having experimented with this system of baffling the elements, I know that it is very efficient and will not raise any difficulty regarding uneven heat throughout the oven, which complaint we are so much accustomed to at present. Regarding the use of only top and bottom heat in an oven, I feel it would not be very successful, especially when one is using two or more trays of goods in the oven at the one time, due to the fact that the centre of the oven would be cold and therefore necessitate the shifting of trays from time to time during firing and, in the case of the top tray, if the product to be cooked is scones and cakes, they would be gripped and so prevented from gaining the necessary bulk; also the opening and closing of the door to fulfil the changing operation would cause a considerable amount of heat losses, especially in such a small chamber as a cooker oven.

The present construction of cookers with side and bottom

heating is fairly good, but on medium heat one is bound to experience uneven heating when the oven is fully loaded, with two or more trays of goods to be fired. By the method I have been experimenting with I found no uneven heat, even when the oven is fully loaded, so by introducing this system of baffling elements, we are assured of even heat throughout the oven at all times, and also assured steady circulation.

Lagging certainly is a vital point in all ovens, no matter whatever function they have to carry out, and enough care cannot be taken when designing these cookers to make sure of quick heating, good retention of heat, and no cold spots due to bad packing of slag wool or lagging; also, all ovens ought to be fitted with a thermometer and small vent on the door.

Now that there are so many different designs of cookers on the market, I feel that a good deal of useful information on this sore question might be obtained by calling for a report from the Electrical Association for Women, that is cooks and users of cookers, and I am sure their information would tend to clear up this matter for all time.

J. D. Taylor,
Graduate I.E.E.

Glasgow, C.2, *February 1st*, 1929.

Relaying Political Speeches.

The Old Country papers, just to hand, give some interesting details of the devices to be used in the coming political campaign, and tell that land lines will be utilised for relaying the speeches. Mr. Neville Chamberlain's speech in Liverpool on January 18th will be heard simultaneously by big audiences in distant towns; likewise the Premier will be heard in eight different towns. The Press speaks of this as an innovation.

Over twenty years ago I urged the adoption of this, and developed several ideas in loud-speakers. It is a strange coincidence that I spoke of the need for relaying the speeches of the late Mr. Joseph Chamberlain, in order that he might be heard in several cities simultaneously. Although I brought my ideas before several firms, no interest could be aroused as to the possibilities in this field.

I would like to pay tribute to the ELECTRICAL REVIEW, always ready to help along new developments, which showed a very helpful interest, publishing the first account in the issue of June 5th, 1908.

N. D. Blagdon Phillips.

Vancouver, B.C., Canada.
January 26th, 1929.

I.E.E. Discussions.

I was glad to see your leader on Electrical Research in which you commented on the poor quality of the discussion at a recent I.E.E. meeting, and could have wished you had made the complaint a more general one. I have been to a number of the Institution meetings in London this winter and have been struck by the excellent quality of the papers and the poorness of the discussions which frequently followed.

In the first place, why cannot speakers get down to their remarks without so much hand-shaking and back-patting? What is the use of escaping from that Victorian convention of wasting the tail end of the evening in votes of thanks if we are only to have the same futilities dragged in at the beginning; far better have it left till the end when one can at least go out and escape it. Criticism (or confirmation) rather than commendation should be the aim.

In the second place, the discussions are usually opened by one or two speakers who are experts in the particular subject covered, but who do not therefore necessarily have anything very special to say. Those responsible for the conduct of these meetings (and the speakers or prospective speakers themselves) should realise that a man need not know as much as the author of the paper in order to contribute something useful to the discussion—what matters is that he should be keen and have a point to put. Even cranks may be useful, if they are limited to a few minutes each. Would it not be possible to reverse the present order and let the young enthusists speak first, rigidly rationed as to time, whilst the benevolent "big guns" wind up the discussion with longer time allowances? I am sure that at present many useful contributions (possibly by younger and less experienced speakers) fail to get delivered.

One final grouse: Why must *every* meeting which starts at 6 o'clock end at 7.30? Some of them deserve to, but others really merit a little longer. After all, if the discussion is worth having it is worth doing really well. Everyone can *read* the papers, and most people can make a summary—the discussion should fill a place which the printed work cannot, in putting the author and his critics face to face.

Member.

February 2nd, 1929.

P.S.—All this sounds perilously like a "grievance." Need I add then that I have no such thing, and that on the few occasions when I myself have had something to say I have been given every reasonable opportunity.

[Owing to pressure on our space, several letters have unavoidably had to be held over.—EDS. ELEC. REV.]

Parliamentary News.

(By Our Special Parliamentary Reporter.)

Electricity Undertakers and Bulk Supply.

On February 4th, Mr. MAITLAND asked the Minister of Transport whether he was aware that, in cases where authorised undertakers required additional supplies now before the bulk supply to be provided under the South-East England Electricity Scheme was available, it was the practice of the Electricity Commissioners, instead of granting sanction for the extension of existing plants, to require the undertakers to endeavour to obtain a bulk supply from the selected station to whom such undertakers would be assigned for bulk supplies when the scheme came into force; that the power companies owning the selected stations thereupon offered a supply conditional on the undertakers entering into an agreement to cease generation themselves and to take from the power companies over a long period of years all the current the undertakers required in bulk at a price higher than the price at which the undertakers could produce in their own stations, and which would be more profitable to the power company than if the supply was made when the scheme came into operation; and whether he would take steps to see that the supply required in such circumstances during the intermediate period was given free from such conditions.

Colonel ASHLEY said he understood that it was the normal practice of the Electricity Commissioners, before deciding whether to grant or refuse consent to the extension of a non-selected generating station, to require the applicants to approach the Central Electricity Board or other appropriate undertakers to ascertain whether a bulk supply could be obtained in lieu of extending the non-selected station, and, if so, on what terms and conditions. He was not aware that the power companies, owning stations which had been determined to be selected stations under the Scheme, offered supplies on the conditions and with the results referred to in the question, but any specific instance of this character brought to their attention would be investigated by the Commissioners.

The Baird Television Co.

On February 5th Mr. THURTLE asked the President of the Board of Trade if he was aware that the Baird Television Development Co., Ltd., had not held any annual meeting or submitted any accounts and balance-sheet since the company was floated in 1927, a period of more than 18 months; and if he was proposing to take any action to enforce the law against that company.

Sir PHILIP CUNLIFFE-LISTER said he understood from the chairman of the company that the meeting was deferred in view of negotiations with the General Post Office and British Broadcasting Corporation, which were in progress in the latter part of the year for the provision of facilities for an experimental broadcast of television; that arrangements had only just reached a stage at which progress could be reported to the shareholders; and that a general meeting was now being convened. In the circumstances, he did not think that any action on his part was required.

The Laying of Post Office Cables.

On February 5th Lord APSLEY asked the Postmaster-General how many miles of telephone and telegraph lines were relaid underground in 1928 and at what cost; and whether he was making any arrangements with electricity supply companies with a view to securing their co-operation where new electric cables were being laid in the same district.

Sir W. MITCHELL-THOMSON said that ducts and cables containing approximately 600,000 miles of wire, were laid underground during 1928 at a cost of £4,280,000. About 40,000 miles of this represented diversion of overhead wire. Arrangements had been in operation for some time past for the exchange of information between the Post Office and other undertakers, including electricity supply companies, with regard to projected underground works, and every endeavour was made to secure co-ordination in this respect; but it was undesirable to lay telephone or telegraph lines in very close contiguity to power circuits.

A Departmental Matter.

On February 7th Viscount SANDON asked the Prime Minister whether, seeing that electricity was not a matter of transport, and that the merchant marine was, he would interchange those two sections of the Ministry of Transport and Board of Trade, respectively, especially in view of the fact that the latter department also had responsibility for gas.

Mr. BALDWIN said he had noted the suggestion, but he did not think that it was practicable.

Cost of Wireless Licences.

On February 7th Colonel HOWARD-BURY asked the Chancellor of the Exchequer whether, seeing that the receipts of wireless licences amounted to £1,250,000, of which £824,000 was paid to the British Broadcasting Corporation and £254,000 to the Exchequer, he could see his way to reduce the wireless licence fee from 10s. to 7s. 6d.

Sir W. MITCHELL-THOMSON, who replied, said he could not. He shared the view expressed by the Crawford Committee

that a fee of 10s., which was equivalent to 1d. for three days' programmes, was not unreasonable, and he did not propose to recommend a reduction.

Sanction to Companies' Reorganisation Schemes.

In reply to a question by Mr. Clynes on February 5th, the PRESIDENT OF THE BOARD OF TRADE said that steps would be taken to bring into force immediately Section 53 of the Companies Act of 1928. This provides that the simple procedure laid down in Section 120 of the 1908 Act for obtaining the sanction of the Court and the consent of the shareholders shall be available in all cases of reorganisation.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

2,022. "Electric switches." C. Hellyar and Anglo-Sphinx Engineering Co., Ltd. October 24th, 1927. (304,380.)

18,453. "Rectifiers for alternating current." Dubilier Condenser Co. (1925), Ltd. September 24th, 1926. (277,537.)

19,257. "Electric current rectifying apparatus." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. July 20th, 1927. (304,336.)

21,365. "Measurement of the transmission time of electrical oscillations." Dr. W. Kunze. August 13th, 1927. (Convention date not granted.) (283,538.)

24,337. "Construction of roofs of electric furnaces and the like." D. F. Campbell. September 15th, 1927. (304,162.)

24,468. "Electric starters for engines." Scintilla Akt. Ges. May 28th, 1927. (291,069.)

26,973. "Audible signalling devices." Sparks-Withington Co. July 15th, 1927. (293,844.)

27,006. "Manufacture of the dollys or operating levers of electric switches." J. A. Crabtree. October 12th, 1927. (304,175.)

27,019. "Means for converting mechanical, acoustic, or the like impulses into electrical impulses." E. W. Braendle and R. H. Billingsley. October 12th, 1927. (304,165.)

27,147. "Illuminated direction-indicators and signals for motor vehicles and the like." Powell & Hanmer, Ltd., and W. J. Daniel. October 13th, 1927. (304,177.)

27,416. "Arrangements for supplying current for the operation of thermionic valve systems." British Thomson-Houston Co., Ltd., A. P. Young, and J. Hutt. October 15th, 1927. (304,167.)

27,435. "Mounting arrangements for automatic switches and the like." Automatic Telephone Manufacturing Co., Ltd., F. Kessler, C. R. Woodland, and J. C. McCrindle. October 15th, 1927. (Addition to 291,151.) (304,169.)

27,490. "Flexible couplings for transmitting rotary motion, adapted for electric locomotive drives." English Electric Co., Ltd., and G. Zweigbergk. October 17th, 1927. (304,342.)

27,555. "Magnet systems for converting electric oscillations into acoustic ones, or *vice versa*." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,347.)

27,557. "Electrical devices such as wireless receiving sets." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,259.)

27,559. "Thermionic valve circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 17th, 1927. (304,222.)

27,587. "Electric contact seam welding machines." W. Meacher. October 18th, 1927. (304,348.)

27,676. "Electrical induction voltage regulating systems." A. Browne. October 18th, 1927. (304,265.)

27,716. "Wireless aerials." A. J. Wilkins. October 19th, 1927. (304,351.)

27,758. "Automatic dial switches." Standard Telephones & Cables, Ltd., G. Hurford, and N. V. Kipping. October 19th, 1927. (304,352.)

27,759. "Circuit interrupting mechanisms for telephone systems." Standard Telephones & Cables, Ltd., B. B. Grace, G. Newton, and C. P. Smith. October 19th, 1927. (304,353.)

27,760. "Electrodeposition of alloys." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). October 19th, 1927. (304,354.)

27,761. "Telephone and like repeater circuits." Standard Telephones and Cables, Ltd. October 19th, 1926. (279,455.)

27,774. "Protection of electric transformers." British Thomson-Houston Co., Ltd., and H. S. Petch. October 19th, 1927. (304,356.)

27,775. "Protective devices." British Thomson-Houston Co., Ltd., and H. S. Petch. October 19th, 1927. (304,357.)

27,814. "Balanced electric protective arrangements." A. Reyrolle & Co., Ltd., and H. C. Atkins. October 19th, 1927. (Cognate application, 9,463/28.) (304,359.)

27,927. "Kinema film with combined sound and picture record, and method of preparing the same." W. E. Beatty. October 20th, 1927. (304,366.)

27,930. "Method of balancing electric cables." Standard Telephones and Cables, Ltd., and J. Collard. October 20th, 1927. (304,367.)

27,935. "Electric oscillation generators." W. S. Smith and W. N. McLachlan. October 20th, 1927. (304,369.)

28,192. "Transmitting apparatus for wireless-telegraphy." J. K. Im Thurn, G. Shearing and C. Matthews. October 24th, 1927. (304,382.)

28,200. "Devices for generating electrical oscillations by means of piezo-electrical crystals." Radiofrequenz Ges. and H. Eberhard. October 26th, 1926. (279,845.)

28,248. "Apparatus for electrically transmitting to a distance the indications of a mensuring instrument or the like." Deutsche Telephonwerke und Kabelindustrie Akt. Ges. October 23rd, 1926. (279,510.)

28,316. "High-tension electric circuit-controlling devices." A. F. Harmer and Drake & Gorham, Ltd. October 25th, 1927. (304,386.)

28,597. "System of illumination." General Electric Co., Ltd., and E. L. Randall. October 27th, 1927. (304,390.)

29,151. "Metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. November 1st, 1926. (279,910.)

29,354. "Laying of electric cables and apparatus therefor." Callender's Cable & Construction Co., Ltd., and L. G. Brazier. November 3rd, 1927. (304,399.)

30,103. "Method for obtaining a perfect high vacuum." Dr. S. Loewe. November 11th, 1926. (280,560.)

30,289. "Electrical signalling apparatus." Magneta Suisse Soc. Anon. November 27th, 1926. (281,265.)

30,615. "Synchronised electric telegraph systems." K. L. Wood and Eastern Telegraph Co., Ltd. November 15th, 1927. (304,417.)

31,547. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 23rd, 1927. (304,423.)

32,856. "Apparatus suitable for the reception of wireless-telephony." Graham Amplion, Ltd., and P. K. Turner. December 5th, 1927. (304,430.)

33,113. "High-frequency coils for electric induction furnaces." G. E. Taylor and Electric Furnace Co., Ltd. December 7th, 1927. (304,432.)

35,342. "Electric switches." General Electric Co., Ltd., H. C. Turner, and A. Sherwin. December 30th, 1927. (304,448.)

1928.

1,702. "Receiving apparatus employed in wireless-telegraphy and telephony." F. Casardi and R. Sarti. January 19th, 1928. (304,469.)

1,785. "Electrical power systems for ship propulsion and other purposes." Metropolitan-Vickers Electrical Co., Ltd. January 19th, 1927. (283,902.)

2,000. "Telephone systems." Telephon-Apparat-Fabrik E. Zweitusch and Co., Ges. January 22nd, 1927. (283,973.)

2,189. "Electric fires or radiators." H. H. Berry. January 23rd, 1928. (304,474.)

2,791. "Electrically-heated ovens." Walker, Hunter & Co., Ltd., and J. Walker. January 26th, 1928. (304,483.)

3,098. "Electromagnetic apparatus for use in the reception or reproduction of sound." C. French. January 31st, 1928. (304,487.)

4,505. "Electric cables." E. S. Ali-Cohen. February 13th, 1928. (304,493.)

5,769. "Ionic valve with two anodes and two grids." Soc. des. Etablissements Industriels de E. C. et de A. Grammont. April 16th, 1927. (288,965.)

7,385. "Electric vacuum tubes." British Thomson-Houston Co., Ltd. March 14th, 1927. (287,087.)

7,943. "Sound-reproducing horn." Electrical Improvements, Ltd., and L. C. Grant. March 15th, 1928. (304,511.)

8,730. "Method of, and apparatus for, switching reproducers from one device to another." Electrical Research Products, Inc. April 1st, 1927. (288,142.)

9,530. "Means for operating mercury switches." Soc. Anon. Hewittic and M. Demontvignier. May 16th, 1927. (Addition to 273,257. (290,597.)

9,676. "Short-circuit-proof safety fuse cartridge with an overload lag." Siemens-Schuckertwerke Akt. Ges. April 9th, 1927. (288,289.)

10,348. "Electric circuit breakers." Metropolitan-Vickers Electrical Co., Ltd. April 6th, 1927. (288,326.)

12,525. "Radio-electric insulating supports." H. Guillou. May 12th, 1927. (290,281.)

13,417. "Electric furnaces for annealing metals." Siemens-Schuckertwerke Akt. Ges. June 15th, 1927. (292,139.)

13,942. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. May 13th, 1927. (290,297.)

14,167. "Picture-projection and sound-reproduction apparatus." De Forest Phonofilms, Ltd. June 18th, 1927. (292,462.)

15,401. "Transformers." International General Electric Co., Inc. May 27th, 1927. (291,107.)

15,557. "Incandescent electric lamps for projection apparatus." Pathé Cinema, Anciens Etablissements Pathé Frères. June 1st, 1927. (291,401.)

15,790. "Telephone cables." Siemens & Halske Akt. Ges. March 3rd, 1928. (Addition to 291,030.) (304,551.)

16,926. "Automatic telephone system." Soc. Anon. de Téléphonic Privée. June 11th, 1927. (292,088.)

17,407. "Mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 20th, 1927. (Addition to 290,297.) (292,506.)

17,598. "Electric control device for machines or apparatus for the sorting, evaluating, or calculating of statistical cards or paper strips provided with perforated symbols." Siemens & Halske Akt. Ges. June 28th, 1927. (292,978.)

23,222. "Single-stage electrically-driven rotary compression or vacuum pumps for braking purposes on vehicles." C. Spirig and Swiss Locomotive and Machine Works. August 11th, 1928. (304,574.)

30,170. "Synchronising synchronous machines." Siemens-Schuckertwerke Akt. Ges. October 19th, 1927. (299,015.)

30,435. "Rectifying units for electric current." Siemens-Schuckertwerke Akt. Ges. and G. Scharowsky. November 14th, 1927. (Divided application on 296,596.) (304,579.)

32,430. "Coating metallic or non-metallic bodies with osmium." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 31st, 1927. (Divided application on 304,396.) (304,580.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 6th:—

Birlec (lettering and design). No. 493,568. Class 8. Electro-magnetic switches, circuit breakers, meters, fitted switchboards, &c., for use in connection with electric furnaces. No. 492,028. Class 18. Electric industrial furnaces.—Birmingham Electric Furnaces, 55, George Street, Parade, Birmingham.

Truphonium. No. 497,984. Class 8. Loud speakers.—Truphonic, Ltd., 121-123, Rosebery Avenue, E.C.1.

Lecoid. No. 496,015. Class 50. Compounds composed principally of bitumen, pitch, resin or wax for sealing electric cable boxes and for the like purposes.—Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.

Research in Italy.

The National Research Council held its inaugural meeting on February 2nd in the presence of Signor Mussolini and of its president, Senatore Marconi, says *The Times*. Modern scientific research, said Signor Mussolini, required an adequate organisation and vast means. It was the lack of these in the past that had led to the present decadence of research and to the paucity of research workers in Italy. To remedy this situation individual research workers needed to be assured that they could "live by science and for science."

The National Research Council, added Signor Mussolini, must keep in living contact with the industrialists, agriculturists, the business men, and the administrative authorities, and in particular with the different confederations of employers and workers, since scientific research ultimately resulted in improvement and increase of production.

The inadequacy of individual and unorganised research was also laid stress upon by Senatore Marconi, who referred to the need of co-ordination and discipline among research workers. It was important, he said, that a discovery made or piece of research work begun in Italy should mature and develop so far as possible in Italy. At the same time, means should be found for a rapid development and application in Italy of inventions made abroad.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALDERSHOT.—Garage, &c., for Gray & Holderness, Ltd., motor engineers.

ALFRETON (DERBYSHIRE).—Re-erection of portion of Alfreton Hall, for R. C. A. Palmer-Morewood.

ATHERTON.—Housing scheme (50), Hag Lane; surveyor to U.D.C.

BIGGLESWADE.—Additional 116 houses, for the R.D.C.; surveyor.

BILLINGHAM (STOCKTON-ON-TEES).—Houses (400), Station Road, for the Synthetic Ammonia and Nitrates, Ltd.

BIRKENHEAD.—Out-patients' department, Children's Hospital, Woodchurch Road; governors. Extensions, Emmanuel Missionary Training Home, Palm Grove; trustees.

BIRMINGHAM.—Factory (£20,000), Tyburn Road; W. H. Briscoe & Co., Ltd., Park Street. Treatment centre, General Hospital; governors. Library, Westley Road; city engineer. Viaduct over New Street station; city engineer. 2,000 houses, Hall Green estate; city engineer.

BOLTON.—Cinema, Churchgate; J. E. Hindle, of Southport, and J. A. Watson, of Preston. 30 houses, Whittle Grove; Leigh Bros., Ltd. Housing schemes, Crumpsall Street, Radcliffe Road, Castle Hill, and Smethurst Lane; borough engineer.

CHELMSFORD.—Additional 100 houses, for the T.C.; borough engineer.

CHISLET (CANTERBURY).—Church (£4,000), for the Wesleyan trustees; G. Browning, builder, Canterbury.

DEVONPORT.—Extensions, cinema, Princess Street; Hippodrome (Devonport), Ltd.

DONCASTER.—Additional 220 houses, Intake, for the T.C.; borough surveyor.

DUDLEY.—Extensions, Netherton Library; W. Lindley.

DUMBARTON.—Workshop, showrooms, &c., for Messrs. McLetchie & Son, motor hirers and agents; the manager.

DUMFRIES.—Town hall (£50,000); burgh surveyor.

EASTBOURNE.—Alterations and additions, Burlington Hotel, Grand Parade; P. D. Stoneham & Son, architects. Conservative hall, Trinity Place; F. G. Cooke, architect.

EDINBURGH.—Additions to cinema, Canning Street, for General Theatre Corporation, Ltd.; the manager.

FIFESHIRE.—Church at Methil Hill (£5,000); the U.F. minister, Methil Hill.

FLEETWOOD.—Central school (about £35,000); H. Stonestreet, district education clerk.

GLASGOW.—Cinema to accommodate 1,700 in Hyndland, for Scottish Cinema and Variety Theatres, Ltd.; Gardner & Glen, architects. Cinema, Cumberland Road; T. Ormiston. 102 houses, Braidfauld Street; housing director.

HEMEL HEMPSTEAD.—Secondary school, for Herts. Education Committee; Kieffer & Dawe, architects.

HITCHIN.—Additional 37 houses and flats, for the U.D.C.; surveyor.

HUDDERSFIELD.—Large extensions to works, Dalton, for British Dyestuffs Corporation.

HULL.—Houses (226), North Hull housing site, and 224 at Willerby Road; D. Darvey, Guildhall.

LEEDS.—Shops and offices, Guildford Street (£120,000); city architect.

LEICESTER.—Grammar school; J. Miller, architect, Glasgow. Wesleyan church; trustees.

LETCHWORTH.—Secondary school (£46,000); B. Parker, architect.

LONDON (EAST HAM, E.).—52 houses, Charlemont Road; E. Ling Cooper.

(BERMONDSEY, S.E.).—340 houses, Rotherhithe slum area; borough engineer.

LONDON—*continued.*

(CAMBERWELL, S.E.).—Buildings, Camberwell New Road; London General Omnibus Co. Building, Basing Road; H.M. Office of Works.

(CATFORD, S.E.).—187 houses, Farm estate, Southend Village; A. J. Glock, Ltd. 60 houses, Winsford Road; Middletons (Builders), Ltd.

(DEPTFORD, S.E.).—Highways depôt, Knott Street; borough engineer.

(ELTHAM, S.E.).—90 houses, Belmont estate; Eley & Allen.

(GREENWICH, S.E.).—Administrative office extensions and women's receiving ward, for the Board of Guardians (£8,261); clerk.

(PLUMSTEAD, S.E.).—52 houses, Thornhill's estate; Wright and Renny.

(WALWORTH, S.E.).—Extension of Browning Congregational Settlement (£50,000); warden.

(PUTNEY, S.W.).—College, West Hill; Sir Giles Gilbert Scott.

(WANDSWORTH, S.W.).—Factory, Merton Road; S. Clifford Tee & Gale.

MANCHESTER.—Patients' workshops, Baguley Sanatorium; J. & J. Parish, Ltd.

NORTHAMPTON.—Premises, for the Town and County Benefit Building Society (£20,969); Frank Allen, surveyor; F. H. Hawtin, builder.

ORSETT (ESSEX).—Housing scheme (94), for the R.D.C.; G. F. Andrassey, surveyor, Palmer's Avenue, Grays.

PAISLEY.—Cinema, for Paisley Picture Theatre Co., Ltd.; manager, High Street.

PLYMOUTH.—38 houses, Stoke Ideal estate; Ideal Estate Co., Ltd.

PUDSEY.—Housing scheme (124) (deposit £5); B. H. Noble, borough surveyor.

RADCLIFFE.—Winding shed, Irwell Bleach and Dyeworks, for Robinson & Co., Ltd.

RICCALL.—School (£6,175), for East Riding E.C.; director of education, Beverley.

ST. ALBANS.—Adaptation of mansion, Hill End Mental Hospital (£1,800); Herts. C.C.

ST. HELEN'S.—Electric lighting installation, heating, and hot-water supply, boys' secondary school, for the borough E.C.; secretary.

SHEFFIELD.—30 houses, Longley estate; J. Laver & Sons, Ltd. Church, Longley estate; Church of England authorities. Sewage works (£84,000); city engineer.

SILKSWORTH.—Remodelling elementary school; Durham County Education Committee.

SMETHWICK.—Clinic, Firs estate (£6,000); borough engineer.

SOLIHULL.—Extensions to grammar school; governors.

SOUTHAMPTON.—Hall of residence, University College (£18,566); A. Saunders, builder, 51, Belmont Road.

SPENBOROUGH.—Housing scheme (136), for the U.D.C.; A. Rothera, surveyor, Cleckheaton.

STOKE POGES.—School, for Bucks. E.C.; C. G. Watkins, secretary, Aylesbury.

STRETFORD.—33 houses, Northleigh Road; W. R. Rochell.

TENTERDEN (KENT).—Additional 48 houses, for the R.D.C.; surveyor.

TIVERTON.—61 houses, for R.D.C.; Mr. Bamsey, architect.

TONBRIDGE.—Extensions, Pembury Institution, for the Board of Guardians; Frank Harris, engineer, 48, Pembury Road (returnable deposit of £1 1s.).

TWICKENHAM.—Foundry, for the Aluminium Plant and Vessel Co., Ltd., Northfield House, Wandsworth Park, S.W.

WAKEFIELD.—Additions, Clayton Hospital, Wentworth Street; Massie & Holdsworth.

WALLINGTON.—Kitchen reconstruction, Belmont colony (£10,360); Metropolitan Asylums Board.

WITHAM (ESSEX).—Central premises, for the Co-operative Society; secretary, High Street.

WORKSOP.—Technical college (£17,000); Greenwoods (Mansfield), Ltd.